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A dictionary of mathematical terms for high school students

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A

DICTIONARY OF MATHEMATICAL TERMS

FOR

HIGH SCHOOL STUDENTS

By

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PREFACE

In compiling and writing this dictionary the needs of the high school student and teacher interested in mathematics have been kept constantly in mind. The mathematics of the high school is perhaps the simplest of its kind and yet very few textbooks carefully define all technical terms as they are introduced. The thoughtful student may turn to an abridged or unabridged dictionary but will find in most cases that the definitions of the terms are vague, often misleading, and in some cases not given.

"It is important that the high school student should understand that mathematics is not the science of that which is absolutely true but a science of 'necessary conclusions'; that all mathematical deductions are of the character'if this, then that'. This implies that there must be assumptions which are not proved -- that in order to make a beginning there must be a number of unproved propositions and undefined elements. One starts with certain raw material and with certain tools and proceeds to erect a structure. These initially assumed elements are the definitions, axioms, and postulates."[1] For the high school student studying mathematics it is desirable that the number of these initial elements should be treated with reasonable brevity and clearness.

The words in the vocabulary have been arranged in alphabetical order so that reference to any one of them might be made in a convenient manner.

[1] Professor Noble's Syllabus, Elementary Geometry for Advanced Students. Course 101, U.C.

PREFACE

Some of the latest editions of mathematical books, as well as the older ones, have been consulted in determing the most concise, complete, and clear definitions.

The terms that are defined are those which would seem likely to trouble the average student studying mathematics in high school for whom the book is written.

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ABACUS. A calculatin frame with sliding counter for computations.

ABBREVATION. A part of a word or phrase used as a symbol for a whole.

ABBREVIATIONS adj. = adjacent; alt. = alternate; ax. = axiom; comp. = complement; con. = construction; cor. = corallary; corr. = corresponding; def. = definition; ex. = exercise; ext. = exterior; hom. = homologous; hy. = hypotenuse; hyp. = hypothesis; iden. = identity; int. = interior; isos. = isosceles; rt. = right; st. = straight; sub. = substitution; sup. = supplementary, or supplement.

ABEL. (1802 - 1829) His investigations, which center about the special class called elliptic functions, added much to the vast progress in the theory of functions.

ABSCISSAS. The distance of any point from the axis of ordinates, measured on a line parallel to the axis of abscissas. See Coordinates.

ABSOLUTE TERM. A term that does not contain an unknown number.

ABSOLUTE VALUE. See Value.

ABSTRACT NUMBER. See Number.

ACCELERATION. The rate of change of velocity with respect to time at any instant t, is called the acceleration at t, its value at t, is given by the derivative $\frac{dv}{dt}$.

ACUTE. Sharp at the end; pointed. ACUTE ANGLE. An angle less than a right angle, as angle A; $\angle A$. ACUTE TRIANGLE. A triangle whose angles are all acute.

ACRE. A measure of land, and may have any shape whatever; 160 square rods, or 43,560 square feet.

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ADDENDS. The numbers to be added.

ADDITION. The process of uniting two or more numbers into one number or sum. The sign for addition is + (called "plus").

FUNDAMENTAL LAWS OF ADDITION. The 'law of order' (the commutative law), and the law of grouping (the associative law). (See Laws)

AFFECTED. adfected; containing different powers of the unknown quantity.

AFFECTED QUADRATIC EQUATION. A quadratic equation that contains both the first and second powers of the unknown numbers.

AGGREGATION. A collection of particulars; suggests the process of gathering, as well as the result. Signs of Aggregation. The symbols or signs of aggregation are the parenthesis ( ), the brace { }, the bracket [ ], and the vinculum $\overline{\quad}$, or bar. They are used to indicate that two or more parts of an expression are to be taken as a whole.

AHMES. (About 1700 B. C.) He was an Egyptian and found the areas of a circle by squaring eight ninths of the diameter, which is approximately the value of π.

ALGEBRA. The mathematical art of reasoning about (quantitative) relations by means of a systematized notation including letters and other symbols; the analysis of equations.

ALGEBRAIC. Of or pertaining to algebra. (Algebraic additions, algebraic division, algebraic expression, algebraic fraction, algebraic function, algebraic notation, algebraic number, algebraic solution, algebraic subtraction, algebraic sums, algebraic surd); see nouns.

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ALTERNATE. Forming or having an alternating series; noting two non-adjacent angles made by the crossing of two lines by a third line, both angles being either interior or exterior, and one being on one side of the third line and the other on the other side.

ALTERNATION. The act of alternating; when the means of a proportion are interchanged to form a new proportion. The new proportion is then said to be the ALTERNATE of the original proportion. Alt. = symbol.

ALTITUDE. Extent or distance upward; height; elevation. (altitude of a cone, altitude of a cylinder, altitude of a parllelogram, altitude of a prism, altitude of a prismatoid, altitude of a pyramid, altitude of a solid, altitude of a trapezoid, altitude of a triangle, altitude of a zone); see nouns.

AMBIGUOUS CASE. (See Case.)

AMOUNT. Total sum. In problems of interest, it is the sum of the principal and the interest.

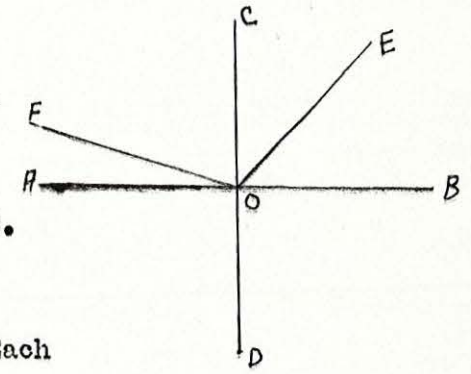
ANALYSIS. Algebraic reasoning, esp., as applied to geometry; also treatment by the calculus.

ANGULAR ANALYSIS. (See Trigonometry.)

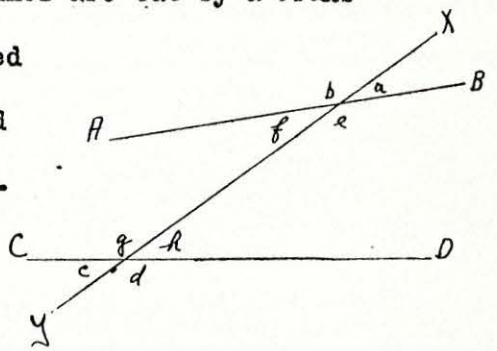
ANALYTIC METHOD OF PROOF. (See Proof)

ANGLE. Symbol = $\angle$; a figure formed by two lines or rays drawn from the same point; the space within lines (straight or curved) or planes so diverging. The half lines are called the ARMS or SIDES of the angle and the common point the VERTEX of the angle. The BISECTOR of an angle is a line through its vertex dividing it into two equal angles. To MEASURE an angle is to find how many times it contains

another angle chosen as a unit. The usual units of measure are the degrees and the radian. CONVEX ANGLE or REFLEX ANGLE. An angle greater than a straight angle but less than two straight angles or a perigon. PLANE ANGLE. An angle formed by two lines. RE-ENTRANT ANGLE. The angle of a concave polygon which is greater than a straight angle. REFLEX ANGLE. See convex angle. RIGHT ANGLE. An angle whose sides are perpendicular each to each; it contains 90°. SALIENT ANGLE. Each angle of a convex polygon and is less than a straight angle. STRAIGHT ANGLE. An angle that is equal to two right angles; hence it contains 180°. (Acute angle, dihedral angle, inscribed angle, obtuse angle, polyhedral angle, spherical angle, trihedral angle, and vertical dihedral angle); see adjectives. (Angle of depression, angle of elevation, angle of inclination, angle of lune, exterior angle of polygon, angle of sector, exterior angle of triangle); see nouns.



ANGLES. ADJACENT ANGLES. Two angles that have a common vertex and one common side between them. If two lines are cut by a transversal the angles b and d, a and c are called ALTERNATE EXTERIOR ANGLES. The angles g and e, f and h are called ALTERNATE INTERIOR ANGLES. CONJUGATE ANGLES. Two angles whose sum is equal to 360°. COTERMINAL ANGLES. Angles which have the same terminal line, as 37 degrees, 397 degrees, and 757 degrees. EQUAL ANGLES. Angles which can be made to coincide. The angles without the two lines A B and C D are EXTERIOR ANGLES.



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EXTERIOR INTERIOR ANGLES or CORRESPONDING ANGLES are the pairs ∠ a and ∠ h , ∠ b and ∠ g, ∠ f and ∠c, ∠ e and ∠ d. Those within the two lines (∠ f, ∠ e, ∠ g, and ∠ h) are INTERIOR ANGLES. HOMOLOGOUS ANGLES. See Corresponding angles of congruent figures. OPPOSITE ANGLES. See Vertical angles. SUPPLEMENTARY ANGLES. Two angles whose sum is equal to a straight angle. VERTICAL or OPPOSITE ANGLES. Two angles with a common vertex and the sides of one the prolongations of the sides of the other. Thus in the figure angles 1 and 2 are vertical angles; likewise angles 3 and 4 (Complementary angles, oblique angles); see adjectives (Corresponding angles of congruent figures, face angles of triangle, angles of a spherical polygon, sum of two angles); see nouns.

ANGULAR ANALYSIS. See Trigonometry.

ANNUITY. A fixed sum of money that is payable once a year, or at more frequent regular intervals, under certain stated conditions. An ANNUITY CERTAIN is one payable for a fixed number of years. A DEFERRED ANNUITY is one that does not begin until after a certain number of years. A LIFE ANNUITY is one payable during the lifetime of a person. A PERPETUAL ANNUITY, or Perpetuity, is one that is to continue forever, as for instance, the rent of a free hold estate.

ANTECEDENT. The first term of a ratio.

ANTECEDENTS. They are the first and third terms of a proportion.

ANTILOGARITHM. The number corresponding to a logarithm.

ANTIPHON. (429-348 B. C.) He introduced the process of exhaustion for the purpose of solving the problem of the quadrature.

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APOTHEM. A perpendicular from the center of a regular polygon to one of its sides. The APOTHEM OF A REGULAR POLYGON is the radius of the inscribed circle.

APOLLONIUS. (260 - 200 B. C.) His genius nearly equalled that of his great predecessor, Archimedes. The brilliancy of his books on "Conic Sections" brought him the title of the "Great Geometer."

ARC. Any portion of the circumference of a circle. ARC -DEGREE. See Degree. MAJOR ARC. An arc greater than a semicircle. MINOR ARC. An arc less than semi-circle.

ARCHIMEDES (287 - 212 B. C.) The greatest contributer to solid geometry was this famous mathematician and physicist of Syracus. At the time of his death, the plane and solid geometry, as given in our high school texts, was almost completed. Books on "Centres of Plane Gravities", the "Sphere" and "Cylinder," the "Measurement of the Circle," on "Conoids" and "Spheroids", on "Spirals", etc., are contributed to him.

ARCHYTAS (428 - 347) B, C.) He was known as a great statesman and general and was the only great geometer among the Greeks when Plato opened his school. The corollary "The Altitude on the hypotenuse of a right triangle is the mean proportional between the segments of the hypotenuse" was known by him.

ARCS. CONJUGATE ARCS are two arcs whose sum is a circumference.

AREA. The amount of surface (plane or curved), as within the lines of a geometrical figure. (Area of circle, area of a square, area of a rectangle, area of a circle, area of a trapezoid, area of a triangle, area of a surface); see nouns. LATERAL AREA. See Lateral.

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ARISTOTLE. (384 - 322 B. C.) He developed and organized the science of logic. Though not a professed mathematician, he promoted the science of geometry by improving some of the most difficult definitions.

ARITHMETIC. The art of computation with figures; the science of numbers.

ARITHMETICAL. Of or pertaining to arithmetic. (Arithmetical means, arithmetical number, arithmetical progression, arithmetical surd); see nouns.

ARMS OF AN ANGLE. See Angle.

ARRANGED. Placed in order. A polynomial is said to be arranged according to the descending powers of a certain letter when the exponents of that letter in successive terms decrease from left to right.

ARRANGEMENT. Something correlated in a particular way; any combination of parts.

ASCENDING. Rising; tending upward; (Ascending Powers); see Powers.

ASSOCIATIVE. Pertaining to the act of being united.

ASSOCIATIVE LAW. See Law.

ASSOCIATIVE LAW OF MULTIPLICATION. See Multiplication.

ASSUMPTION. The act of assuming; suppostion, or a thing supposed; the part of a theorem that is given.

ASTERLOBE. ("To take a star") An instrument formerly used to find the angle of elevation of a star, or of any other heavenly body.

ASYMPTOTE. A straight line that is continually approached by a

curve but does not meet it within finite distance. It is the limiting position to a curve of a tangent whose point of contact moves off to an infinite distance from the origin. It is the limiting position of a secant as two points of intersection of the secant with a branch of the curve move off in the same direction along that branch to an infinite distance.

AUXILIARY CIRCLE. See Circle.

AVERAGE. A measure of central tendency, used commonly as the arithmetic mean for example, half the sum of two numbers. The determination of a quantity intermediate to a number of different quantities (as by adding them and dividing the sum by their number).

AXIOM. Sym. ∴ Ax. A statement admitted to be true without proof.

AXIOM OF PARALLELS. See Parallels.

AXIOMS. Plural of axiom.

AXES. Plural of axis. Two lines which are at right angles to each other and used as reference lines. AXES of REFERENCE. See reference.

AXIS. An imaginary line about which a body rotates; a central or principal line in a symmetrical arrangement or in any system. (Axis of abscissas, Axis of circle, axis of sphere, axis of circular cone, axis of circular cylinder, axis of cone, axis of pyramid, axis of symmetry); see nouns.

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BAR. A horizontal or vertical line. See Aggregation.

BAR GRAPH. See Graph.

BASE. The line or surface forming that part of a figure on which it is supposed to stand. II The number which serves as a starting point for a logarithmic or other system. (Base of a cone, Base of a frustum, Base of a polygon, base of a polyhedron, Base of a pyramid, Base of a solid, Base of a spherical pyramid, Base of a spherical sector, Base of a trapezoid, Base of a triangle); see nouns.

BASES. (bases of a cylinder, bases of a prism, bases of a (zone); see nouns.

BINOMIAL. A polynomial of two terms.

BINOMIAL DIFFERENTIAL. A differential of the form $x^m(a+bx^n)^p dx$, where a and b are any constants and the exponents m, n, and p are rational numbers.

BINOMIAL FORMULA. See Formula.

BINOMIAL QUADRATIC. See Quadratic.

BINOMIAL QUADRATIC SURD. See Surd.

BINOMIAL THEOREM. See Theorem.

BIQUADRATIC. Of or pertaining to a fourth power. (Biquadratic equation); see equation.

BIRECTANGULAR. A spherical triangle of two right angles.

BISECT. To divide into two equal parts.

BISECTOR. A bisecting line. (Bisector of an angle, bisector of a line, bisector of a line-segment); see nouns. PERPENDICULAR

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BISECTOR is a line which bisects a given line and is perpendicular to it.

BOLYAI. (1802 - 1860 A. D.) He was educated for the army, and destinguished himself as a profound mathematician, an impassioned violin-player, and an expert fencer. He published an appendix composed of 26 pages of his new "NoneEuclidean Geometry."

BRACE. $\left\{ \right.$ $\left. \right\}$ A symbol of aggregation.

BRACKET. [ ] A symbol of aggregation.

BREADTH. The distance from front to back; extent across. See width.

BROKEN-LINE. See Line.

BROKEN-LINE GRAPH. See Graph.

BRIGGSIAN SYSTEM OF LOGARITHMS. See Logarithms.

BUNDLE OF LINES. See Lines.

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CASE. State, condition, or situation. AMBIGUOUS CASE. Uncertain condition.

CANCEL. To eliminate by striking out (a factor common to both terms of a fraction, equivalent quantities on opposite sides of an equation, etc.); balance and eliminate (an equivalent opposed quantity).

CARDINAL. Of prime importance; principal or fundamental. The four CARDINAL POINTS of the compass are the north, south, east, and west points; the CARDINAL NUMBERS are one, two, three, etc.

CARDIOID. The one-cusped epicycloid traced by any point of a circle that rolls all round on an equal circle.

CATENARY. A certain curve, approximately that assumed by a chain suspended freely by its ends.

CAUCHY. 1780 - 1857) He was a prolific and profound mathematician. Byaa prompt publication of his results, and the preparation of standard text-books, he exercised a more immediate and beneficial influence upon the great mass of mathematicians than any contemporary writer. His researches extended over the field of series, of imaginaries, theory of numbers, differential equations, theory of substitutions, theory of functions, determinants, mathematical astronomy, light elasticity, etc., - covering pretty much the whole realm of mathematics, pure and applied.

CAYLEY. (1821 - 1895) He was educated at Trinity College, Cambridge. While a student of the bar he made some brilliant discoveries in mathematics. There is hardly any subject in pure mathematics which the genius of Cayley has not enriched, but most important was his creation

of a new branch of analysis by his theory of invariants.

CENTER. A point of attraction or radiation within a circle or sphere equally distant from all points of the circumference or surface. (Center of circle, center of gravity, center of polygon, center of similtude, center of sphere, center of symmetry); see nouns.

CENTER-LINE. A line determined by the centers of two circles.

CENTER-SEGMENT. A segment of the center-line between the centers.

CENTERS. Plural of center; the line determined by the centers of two circles is the LINE OF CENTERS.

CENTIMETER. In the metric system, a measure of length equal to one hundredth of a meter, or 0.3937 inch. Ten millimeters make a centimeter.

CENTRAL ANGLE. An angle whose vertex is at the center of a circle and its sides are radii of the circle. The CENTRAL ANGLE OF a regular polygon is the angle formed by two radii drawn to any consecutive vertices.

CENTROID OF TRIANGLE. See Triangle.

CHAINS. See Surveyor's Chains.

CHAINING PINS. Pins used to mark the end-point of the chain or tape, in measuring distances.

CHARACTERISTIC. The integral part of a logarithm.

CHECK. Another operation which tests the correctness of the

first operation. A CHECK, or TEST, of the correctness of the result obtained by solving the equation can be made by substituting in the original equation the results in place of the unknown numbers. Both members of the equation must then reduce to the same number.

CHECKING. See Verifying. The substitution of numerical values for letters in order to test the correctness of an operation in CHECKING THE RESULT.

CHORD. A line segment joining two points on a circle. CHORD of CONTACT. See Contact.

CIRCLE. sym = $\odot$ A closed plane curve all points of which are equally distant from a point within called the center. AUXILIARY CIRCLE is the circle described upon the major axis of an ellipse as a diameter. The area inclosed by a circle is the AREA OF A CIRCLE. A of $\odot = \pi r^2$. The diameter perpendicular to the plane of a circle of a sphere is the AXIS OF THE CIRCLE. A DIAMETER OF A CIRCLE is a line-segment joining two points on the circumference and passing through the center. When the plane of the circle passes through the center of the sphere, their curve of intersection is a GREAT CIRCLE. A triangle or a polygon is said to be INSCRIBED in a circle When its vertices all lie on the circle, and the circle under these conditions is said, to CIRCUMSCRIBE THE TRIANGLE or the polygon. The MAJOR ARC of a cricle is the larger arc, and the smaller arc is the MINOR ARC. The intersection of a sphere made by a plane is a CIRCLE OF A SPHERE. The distance from any point on a circle of a

sphere to its nearer pole is the POLAR DISTANCE of the circle. The distance between two points on the surface of a sphere is the arc of a great circle that joins them. The diameter of the sphere that is perpendicular to the plane of a circle of the sphere is the AXIS of the CIRCLE, and the ends of this diameter are the POLES of the circle. The QUADRATURE of THE CIRCLE is one of the three famous problems of geometry. This problem is to find the length of a side of a square whose area is equal to that of the circle and involves the finding of the exact value of the ratio of the circumference to the diameter of a circle. The RADIUS OF A CIRCLE is the line segment joining the center to any point on the circle. When the plane of the circle does not pass through the center of the sphere, their curve of intersection is a SMALL CIRCLE OF THE SPHERE. A SECTOR of a circle is the figure formed by two radii and their intercepted arc.

CIRCLES. CONCENTRIC CIRCLES are circles that have the same center. TWO CIRCLES are TANGENT to each other when they are tangent to the same line at the same point.

CIRCULAR. Of or pertaining to a circle; having the form of a circle. (Circular cone, circular cylinder, circular graph, circular permutations, circular right cone, circular cylinder); see nouns.

CIRCUMCENTER. The point of intersection of the perpendicular bisectors of the sides of a triangle.

CIRCUMFERENCE. The length of the circle; the distance around the surface enclosed.

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CIRCUMSCRIBE. To draw a line or figure around another figure so as to touch as many points as possible; of a figure, to inclose (another figure) in this manner. (Circumscribed cylinder, Circumscribed frustum, circumscribed, polygon, circumscribed polyhedron, circumscribed pyramid); see nouns.

CIRCUMSCRIPTIBLE. Capable of being circumscribed. For example, a pplygon circumscribes a curve when all its sides are tangent to the curve. A curve circumscribes a polygon when it passes through all the vertices of the polygon.

CISSOID. A curve invented by Diocles (? 180 B. C.) for the purpose of solving the celebrated Delian problem of the ancient geometry, viz, to duplicate a cube, or to construct two geometrical means between two given line segments.

CLEARING OF FRACTIONS. See Fractions.

CLOCK-WISE. In the directon of rotation of the hands of a clock. COUNTER CLOCK-WISE. In the opposite direction of clockwise.

CLOSED. Shut in or surrounded on all sides. (Closed line, closed solid figure); see nouns.

COEFFICIENT. A number or quantity placed (generally) before and multiplying another quantity (as, 3 is the COEFFICIENT OF x in 3 x). NUMBERICAL COEFFICIENT. A coefficient composed of figures.

COEFFICIENTS. UNDERTERMINED COEFFICIENTS. Assumed coefficients whose values not known at the outset and which are to be determined in the course of the demonstration of a theorem or the solution of a problem.

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CO-FACTOR. One of a number of factors in a product. See Coefficient.

COINCIDE. To occupy the same position in space.

COLLINEAR. Lying in the same straight line.

COLOGARITHM. The logarithm of the reciprocal of a number.

COLUMN. A vertical series of figures or terms. The vertical lines in the square form of a determinant.

COMBINATION. The arrangement of a number of individuals into various groups, each group containing a given number of the individuals (as a, b, and c into ab, ac, and bc): also one of the groups formed.

COMMENSURABLE. Having a common measure or divisor. Two magnitudes are said to be COMMENSURABLE when they have a common measure.

COMMON DIVISOR. See Divisor.

COMMON EXTERNAL TANGENT. See Tangent.

COMMON FACTOR. See Factor.

COMMON INTERNAL TANGENT. See Tangent.

COMMON MULTIPLE. See Multiple.

COMMON SOLUTION OF TWO EQUATIONS. See Equations.

COMPASS. The inclosing line or limits of any area.

COMPASSES. An instrument for describing circles, measuring distances, etc., consisting generally of two adjustable legs hinged at one end.

COMPLEMENTARY ANGLES. Two angles whose sum is equal to a right angle. Each of the angles is a complement of the other.

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COMPLETE QUADRATIC. See Quadratic.

COMPLETE QUADRATIC EQUATION OF CONDITION. See Equation.

COMPLETE REVOLUTION. See Revolution.

COMPLEX. Characterized by an involved combination of parts. (Complex expression, complex fraction, complex number, complex nuerator); see nouns.

COMPOSITION. When the sums of antecedents and consequents are compared with either antecedents or consequents to form a new proportion.

COMPOUND. To make or form by combining parts, elements. (Compound expression, compound fraction, compound number); see nouns.

COMPUTATION. Calculation. RULE OF COMPUTATION. A rule which expresses in words the relation of one number to one or more other numbers.

CONCAVE. Curvedlike the interior of a circle or of a hollow sphere; hollow and curved. CONCAVE POLYGON. See Polygon.

CONCENTRIC Having a common center, as circles or spheres.

CONCENTRIC CIRCLES. See Circles.

COHCHOID. A curve of the fourth degree, invented and mechanically constructed by Nicomedes (? 180 B. C.) as serving both to trisect an angle and to duplicate a cube.

CONCLUSION. The statement of what is to be proved.

CONCRETE. Noting a number which relates to a particular object or thing. RATIO OF TWO CONCRETE QUANTITIES. See Quantities.

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CONCYCLIC. Points lying on the same circumference.

CONCURRENT. Meeting in the same point; occurring or existing together or side by side. CONCURRENT LINE. See Line.

CONDITION. That on which something else is dependent. COMPLETE QUADRATIC EQUATION OF CONDITION. See Complete Quadratic Equation.

CONDITIONAL EQUATION. See Equation.

CONE. A closed solid figure bounded by one nappe of a conic surface whose directrix is closed curve, and by a plane cutting all of the elements. The ALTITUDE of a cone is the perpendicuar distance from the vertex to the base. The AXIS of a circular cone is the line-segment from the vertex to the center of the base. The curved surface is the LATERAL SURFACE and the section made by the plane is the BASE. A CIRCULAR CONE is a cone whose base is a circle. The fixed curve is the DIRECTRIX OF THE CONE. The generatrix in any of its positions is an ELEMENT of the cone. A FRUSTUM of a cone is that part of the cone included between the base and a section made by a plane parallel to the base. The moving straight line is the GENERATIX. HEIGHT of a cone. See Altitude. HEIGHT (altitude) OF THE FRUSTUM of a cone is the perpendicular distance between the bases. OBLIQUE CONE. The axis of the cone is oblique to the base. A plane is TANGENT to a cone when it contains one element and no other line or point of the cone. RIGHT CONE. A cone whose axis is perpendicular to the base. RIGHT CIRCULAR CONE. A circular cone whose altitude meets the base at its center. The SLANT HEIGHT of a right circular cone is the length of an element. The VERTEX

of the cone is the point of the conical surface . TRUNCATED CONE. The portion of a cone included between the base and plane cutting all the elements.

CONFOCAL. Having the same focus or foci. A family of confocal conics is an indefinite number of conics having the same foci.

CONGRUENT, Agreeing. CONGRUENT FIGURES. Any two geometric figures are said to be congruent if one can be placed on the other so that the two figures coincide. The symbol for congruence is $\cong$. CORRESPONDING ANGLES OF CONGRUENT FIGURES are those angles which coincide. (Congruent solids, congruent triangles); see nouns.

CONIC Having the form of or resembling a cone; round, and tapering to a point; also, pertaining to a cone.

CONIC SECTION. A curve formed by the intersection of a plane with a right circular cone, as an ellipse, a parabola, or a hyperbola.

CONICAL SURFACE. A surface generated by a moving straight line which constantly intersects a fixed curve and passes through a fixed point not in the plane of the curve. If the generatrix is unlimited in extent the conical surface will consist of two parts, the UPPER and LOWER NAPPES. (Directrix of conical surface, element of conical surface, generatrix of conical surface, vertex of conical surface); see cone.

CONJUGATE. Of two points, lines, etc., so related as to be interchangeable in the enunciation of certain properties. (Conjugate arcs, conjugate angles, conjugate complex number, conjugate radical, con-

jugate surds); see nouns.

CONSECUTIVE. Following one another in uninterrupted succession. (consecutive integers, consecutive vertices); see nouns.

CONSEQUENT. The second term of a ratio. See Antecendent.

CONTACT. The state or fact of touching. The ELEMENT OF CONTACT is the element contained by the plane. The CHORD OF CONTACT is the line joining the points of contact for the two tangents drawn from a point to the curve. POINT OF CONTACT. See point of tangency.

CONSTANT. A quantity assumed to be invarialbe throughout a given discussion. CONSTANT TERM. See Term.

CONTRADICTORY. Asserting the contrary or opposite. CONTRADICTORY EQUATION. See Equation.

CONSTRUCTION. The representation of a required figure by means of points and lines.

CONTINUE. To make continuous, connect, or unite; also to extend from one point to another in space. (Continued fraction, continued proportion); see nouns.

CONTINUOUS. Holding together without break or interruption.

CONVERGE. To tend to meet in a point, line, or value; incline toward each other, as lines which are not parallel; to come together by gradual approach. To approach a limit as in the sums of an infinite series.

CONVERGENT. Converging; formed by convergence; as of lines. INFINITE CONVERGENT SERIES. See Series.

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CONVERGENTS. The fractions obtained by stopping at the first, second, third, -------, quotients of a continued fraction, as $\frac{a_1}{1}$, $a_1 + \frac{1}{a_2}$, $a_1 + \frac{1}{a_2} + \frac{1}{a_3}$ or when reduced to the common form $\frac{a_1}{1}$, $\frac{a_1 a_2 + 1}{a_2}$, $\frac{a_3(a_1 a_2 + 1) + a_1}{a_3 a_2 + 1}$----------are called respectively the first, second "third", - - - - CONVERGENTS.

CONVERSE. A thing which is the opposite or contrary of another.

CONVERSE THEOREM. See Theorem.

CONVERSE SINE. See Sine.

CONVEX. Curved like a circle or sphere when viewed from without; bulging and curved. CONVEX ANGLE. See Angle.

CONVEX CONIC SURFACES. See Conic Surfaces.

CONVEX POLYHEDRAL ANGLE. See Polyhedral.

COORDINATES. Any of two or more magnitudes which define the position of a point, line, or the like by reference to a fixed figure system of lines, etc., esp., either of two lines ("cartesian coordinates")defining the position of a point in a plane, with reference to two intersecting fixed lines or axes, each defining line being drawn from the point to one axis, parallel to the other axis (The defining line drawn to the horizontal axis or to a corresponding length along the other axis is the ORDINATE; and the defining line parallel to the horizontal axis or to a corresponding length along the horizontal axis is the ABSCISSA.) RECTANGULAR COORDINATES. The abscissa and ordinate of a point referred to two perpendicular axes are called the RECTANGULAR coordinate of the point. OBLIQUE COORDINATES. When the abscissa is not perpendicular to the ordinate .

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COROLLARY. A statement that follows directly as the result of another statement.

CORRESPONDING LINES. See Lines.

CORRESPONDING POINTS. See Points.

COSECANT. The secant of the complement of a given angle or arc. The ratio of the hypotenuse to the opposite leg.

COSINE. The constant ratio of the side adjacent of an acute angle of a right triangle and the hypotenuse. LAW OF COSINES . The relationship between an angle of a triangle and the three sides. e. i.

$$a = b^2 + c^2 - 2bc \cdot \cos A$$

CONTANGENT. The tangent of the complement of a given angle or arc. The constant ratio of the adjacent leg of a right angle to the opposite leg.

COTERMINAL ANGLES. See Angles.

CUBE. A rectangular parallelepiped all of whose edges are equal. CUBE ROOT. See Root.

CUBIC. Having the form of a cube, also of three dimensions, solid or pertaining to solid content, as a cubic foot, the volume of a cube whose edges are each a foot long; being of the third power or degree. CUBIC MEASURE. The measurement of volume in cubic units; a system of such units, the one in which 1,728 cubic inches = 1 cubic foot, 27 cubic feet = 1 cubic yard.

CURVATURE. A rate of change of direction and is denoted by K. The shape of a curve depends very largely upon this rate at which the direction of the tangent changes as the point of contact describes the curve.

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CURVE. The path of a point represented by certain variables which satisfy a given condition. The curve as expressed geometrically is called a graph of the algebfaic function of the variables.

CURVED LINE. See Line.

CURVED SURFACES. See Surfaces.

CURVILINEAR FIGURES. See Figures.

CUSP. A point at which two branches of a curve meet and stop and have a common tangent. There are two kinds of cusps: First, when the two branches lie on opposite sides of a common tangent; second, when the two branches lie on the same side of the common tangent.

CYCLIC SUBSTITUTION. See Substitution.

CYCLOID. The path described by a point on the circumference of a circle which rolls without sliding on a fixed straight line.

CYLINDER. A closed solid figure bounded by two parallel plane suffaces and by a cylindrical surface whose directrix is a closed curve. The ALTITUDE OF A CYLINDER is the perpendicular distance between its bases. The curved surface is spoken of as the LATERAL SURFACE and the plane surfaces as the BASES. CIRCULAR CYLINDER. A cylinder whose bases are circles. CIRCULAR RIGHT CYLINDER. See cylinder of revolution. A prism is CIRCUMSCRIBED about a cylinder when the lateral faces are tangent to the cylinder and the bases are circumscribed about the bases of the cylinder. The CYLINDER is said to be INSCRIBED in the prism. CYLINDER OF REVOLUTION. See Revolution. OBLIQUE CYLINDER. A cylinder whose elements are oblique to the bases. See prism. RIGHT CYLINDER.

A cylinder whose elements are perpendicular to the bases. A RIGHT SECTION of a cylinder is the section made by a plane cutting all of the elements at right angles. A SECTION of a cylinder is the figure formed by the intersection of a plane and a cylinder. If two similar rectangles are revolved about corresponding sides as axes, the cylinders generated are SIMILAR CYLINDERS of REVOLUTION.

CYLINDRICAL SURFACE. A surface generated by a moving straight line, which is always parallel to a fixed straight line, and which intersects a fixed curve not in the plane of the straight line. The moving line is the GENERATRIX and the fixed curve the directrix of the surface. The generatrix in any of its positions is an ELEMENT of the cylindrical surface.

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DECAGON. A polygon of ten sides.

DECIMAL. Pertaining to tenths, usually indicated by figures written to the right of the decimal point. DECIMAL NUMBER. See number.

DECIMETER In the METRIC SYSTEM, a measure of length equal to one tenth of a meter, or 3.937 inches.

DEFERRED ANNUITY. See Annuity.

DEFINITION. A description given in such a way that the object is distinguished from all other objects.

DEGREE. In ALGEBRA rank as determined by an exponent or sum of exponents (as, a^3 and $a^2 b$ are terms of the third DEGREE; $2x^2y + ax =$ $= 4$ is an equation of the third DEGREE, three being the sum of the exponents of the unknown quantities in that term in which such sum is the greatest). In GEOMETRY the 360th part of the circumference of a circle, as used to measure arcs and angles. One DEGREE $= \frac{\pi}{180}$ radians $=$ .01745. ARC DEGREE. One of the parts of an arc whose central angle is a right angle and is divided into ninety equal parts. Any circle contains three hundred and sixty arc degrees. SPHERICAL DEGREE The SPHERICAL triangle having two sides equal to quadrants and the included spherical angle equal to one degree is used as the unit of measure of areas of spherical polygons. SECOND DEGREE. See Function. (Degree of an equation, degree of a term); see nouns.

DEMONSTRATION. The course of reasoning by which we prove a theorem to be true.

DENOMINATOR. The number in a fraction below the line. It is the divisor in an algebraic fraction.

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THE LOWEST COMMON DENOMINATOR (L.C.D.) of two or more fractions is the least common multiple (L.C.M.) of their denominators.

RATIONALIZING the DENOMINATOR. The process of changing the denominator to a rational number by not changing the value of the fraction.

DEPENDENT EQUATIONS. See Equation.

DEPENDENT VARIABLE. See Variable.

DEPRESSION, ANGLE OF. When the angle made with the horizontal plane is below the line joining the obeerver's eye with a distant object.

DERIVATIVE OF A FUNCTION. It is the limit of the ratio of the increment of the functions to the increment of the independent variable, when the latter increment varies and approaches the limit zero. The deriviative of y with respect to x is the limit of the ratio $\frac{\Delta y}{\Delta x}$ as Δx approaches 0. The symbol is $\frac{dy}{dx}$, y' (when y is a function of x) and $f'(x)$. The derivative of a function is identical with its rate of change. Geometrically the derivative of a function for a certain value of the variables is the slope of the tangent to the curve of the function at that point; sometimes called the differential coefficient.

DESCARTES (1596 - 1650 A. D.) He has been celebrated not only as a great metaphysician but as a great mathematician. His geometry was called "Analytical geometry" partly because, unlike the synthetic geometry of the ancients, it is actually "Analytical", in the sense that the word is used in logic; and partly because the practice had then already arisen of designating by the term "Analysis" the calculus with general quantities. He also established some theorems on the theory of equations. Celebrated

is his "rule of signs" for determining the number of positive and negative roots.

DESCENDING POWERS. See Powers.

DETERMINATE. Known of capapable of being known.

DETERMINANT. A symbol in the form of a square array, consisting of rows and columns of terms called elements the order of the determinant being that of the number of columns in rows. An expression of the form of the difference of two products e. g. $cb_1 - c_1 b$ or $\begin{vmatrix} c & b \\ c_1 & b_1 \end{vmatrix}$ is a determinant of the second order.

DETERMINATE EQUATION. See Equation.

DETERMINATE PROBLEM. See Problem.

DEVELOP. To express in an extended form, as in a series. DEVELOP a FUNCTION. Find a series the sum of which is equal to the function. Hence the DEVELOPMENT OF A FUNCTION is either a finite or a convergent infinite series.

DIAGONAL. A line that joins opposite corners (vertices) of a rectangle. (Diagonal of a polygon, diagonal of a polyhedron, diagonal of a spherical polyhedron); see nouns.

DIAGONAL SCALE. See Scale.

DIAMETER. A straight line through the center of a closed curve or surface terminated by the boundary. A chord that passes through the center of a circle. (Diameter of a circle, diameter of a sphere); see nouns.

DIFFERENCE. The result of subtracting one number from another ie., the DIFFERENCE is the number that added to the subtrahend gives the minuend.

DIFFERENCE OF SQUARES. See Square.

DIFFERENTIAL. Pertaining to or involving differentials(as, differential calculus; a DIFFERENTIAL COEFFICIENT, the measure of the rate of change of a function relatively to its variable). An infinitesimal difference between consecutive values of a variable quantity. Also, the differential dx of the independent variable x is any assigned increment of x. The differential dy of the dependent variable y in the relation $y = f(x)$ is the product of the derivative $f'(x)$ of the function by the differential dx of the independent variable, or $dy = f'(x)\,dx$.

DIFFERENTIATION. The operation of finding the derivative.

DIFFERENTIAL EQUATION. See Equation.

DIFFERENTIATE. To form the differential, or differential coefficient of a function.

DIHEDRAL ANGLE. An angle formed by two planes that intersect. Their line of intersection is the edge and the planes are the FACES of the dihedral angle. Two VERTICAL DIHEDRAL ANGLES are DIHEDRAL ANGLES that have the same edge and the faces of the one are the prolongations of the faces of the other.

DIMMENSIONS. Magnitude measured in a particular direction, or along a diameter or principal axis; length, breadth, or thickness; a mode of spatial extension; in algebra, a^3 and a^2b and $2abc$ are terms of three DIMENSIONS, or of the third degree. DIMMENSIONS OF THE THIRD DEGREE, see Degree.

DIRECT VARIATION. See Variation.

DIRECTED NUMBERS. See Numbers.

DIRECTION. The line toward some point or region, or the point or region itself as indicating position of course. The position of one point in relation to another without reference to the intervening distance.

DIRECTRIX. A fixed line or curve used as a guide in describing a curve or surface. The polar of a focus; a line whose distance from any point of a conic is in fixed ratio to the distance of the same point from a focus. A curve along which the generatrix glides in describing a surface. DIRECTRIX of a CONICAL SURFACE, see conical surface; DIRECTRIX of a CYLINDRICAL SURFACE, see cylindrical surface.

DISCRIMINANT. Distinguished by certain tokens. The discriminant of $f(x) = a_0 x^n + \dots + q_n = 0$ is that integral function of the coefficients of $f(x) = 0$ which is a necessary and sufficient condition that $f(x)$ has a multiple root. The expression $\frac{q^2}{4} + \frac{p^3}{27}$ is called the discriminant of the cubic $x^3 + px + q$, since its vanishing is the condition that two of the roots be equal. The radicand $b^2 - 4ac$ is called the discriminant of $ax^2 + bx + c$.

DISCUSSION. The examination of a problem with reference to all possible conditions, particularly with respect to the number of conditions.

DISSIMILAR TERMS. Terms which do not have the same literal factors. See Terms.

DISTANCE. The length of the straight line that joins two points; the length of the perpendicular from an external point to a line; the space passed over by a moving body is called the DISTANCE, and the number of units of distance traversed is represented by D. DISTANCE

BETWEEN PARALLELS. The distance between two parallels is measured on a line perpendicular to both parallels (the shortest distance from a point on one line to the other line is a perpendicular from the point to the second line). DISTANCE FROM POINT TO A PLANE. The perpendicular is the shortest line from an external point to a given plane. DISTANCE OF A POINT. See point. POLAR DISTANCE. The spherical distance from the nearer of the poles of a small circle to any point on the circle. SPHERICAL DISTANCE. The length of the minor arc of a great circle passing through two points.

DISTRIBUTION-LINE GRAPH. See Graph.

DISTRIBUTIVE LAW. See Law.

DISTRIBUTIVE LAW OF MULTIPLICATION. See Multiplication.

DIVERGENT INFINITE SERIES. See Series.

DIVIDE. To separate into equal parts by the process of division.

DIVIDEND. A number or quantity to be divided by another number or quantity.

DIVISION. The process of finding one of two numbers, or factors, when their product and the other number, or factor, are given. ALGEBRAIC DIVISION. The operation of finding the other factor, having given an algebraic product and one factor. SYNTHETIC DIVISION. A method of shortening the work of division by omitting the various powers of x, and writing only the coefficients.

DIVISOR. The number by which we divide and represents one factor of the dividend; the given factor or number in division. COMMON DIVISOR, or common factor, of two or more numbers is an exact divisor of each of them. HIGHEST COMMON DIVISOR the expression of highest degree that will divide each of them exactly.

DODECAHEDRON. A polyhedron of twelve faces; a solid formed by twelve pentagons for its sides.

DOUBLE POINT. A point at which there are two tangents to the curve at that point (whether distinct, coincident, or imaginary).

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ECCENTRICTY. A ratio equal to the distance between any point of a conic section and its focus divided by the distance between the same point and the corresponding directrix.

EDGE. The line in which two surfaces of a solid object meet.

EDGES. EDGES OF A DIHEDRAL ANGLE. See Dihedral Angle. EDGES OF A PYRAMID. See Pyramid.

ELEMENT. One of the points, lines, planes, or other geometrical forms, by which a figure is made up; any straight line in a cylindrical or conical surface, corresponding to some position of the moving line by which the surface was generated. (See conical surface). (See cylindrical surface). ELEMENT OF CONTACT. See Contact.

ELEMENTS. The numbers of a determinant.

ELEVATION. The state of being elevated. ANGLE OF ELEVATION. The angle made with the horizontal plane, by the line joining the observer's eye, (WHEN THE OBJECT IS ABOVE THE OBSERVER) with a distant object.

ELLIPSE. A curve which is the locus of a point that moves in a plane so that the sum of its distances from two fixed points in the plane is constant. Each of the two fixed points is called a FOCUS of the ellipse. The ratio of the Linear eccentricty to the semi major axis is the ECCENTRICITY of the ellipse. The distance of the center from each of the foci is the LINEAR ECCENTRICITY of the ellipse.

ELIMINATION. A process of deriving a simple equation in one unknown from a system of two or more simultaneous equations in two or more unknowns.

ENTIRE. See INTEGRAL NUMBER. (Entire surd); see noun.

ENUNCIATION. Statement. GENERAL ENUNCIATION. See General.

ENVELOPE. The locus of the intersections of consecutive elements

of a family of curves on surfaces. The curve to which each curve of the family is tangent. This curve was also used in the attempt to square the circle.

EQUAL. Like in quantity, degree, value, etc. EQUAL SEGMENTS. See Segments. Whenever two geometric figures have the same area they are equal in AREA. The symbol is =. Two magnitudes which can be so applied to each other that each shall coincide with the other throughout its whole extent are IDENTICALLY EQUAL.

EPICYCLOID. A curve traced by a point of a circle that rolls on the outside of a fixed circle.

EQUALITY. The state of being equal. EQUALITY EQUATION. See EQUATION. The TEST OF EQUALITY of two geometric magnitudes is that they may be made to coincide throughout their whole extent.

EQUATION. An expression if, or a proposition asserting, the equality of two quantities, employing the sign = between them. AFFECTED QUADRATIC EQUATION. A quadratic equation that contains both the first and second powers of the unknown numbers. BIQUADRATIC EQUATION. An equation of the fourth degree. COMPLETE QUADRATIC EQUATION. An equation having only one unknown, in which the unknown does not appear in the denominator of the equation, and in which the first and second powers of the unknown do appear. CONDITIONAL EQUATION. An equation that can be satisfied by only one or by a definite number, of values of the letters in it. CUBIC EQUATION. An equation of the third degree. The DEGREE OF AN EQUATION in one unknown is the degree of the highest power of the unknown number. DETERMINATE EQUATION. An equation which has one root, or a limited num-

er of roots. DIFFERENTIAL EQUATION. An equation that involved derivatives or differentials. EXPONENTIAL EQUATION. An equation in which the unknown quantity appears in an exponent of some term or factor. FRACTIONAL EQUATION. An equation in which the unknown is contained in a denominator. GRAPH of an EQUATION. The line or curve containing all the points, and only those, whose coordinates satisfy a given equation. HIGHER EQUATION. An equation that contains a higher power of the unknown number than the second. IDENTICAL EQUATION. See Identity. IMPOSSIBLE EQUATION. An equation that has no solution. INDETERMINATE EQUATION. An equation that admits of an infinite number of solutions. IRRATIONAL EQUATION. An equation containing an irrational root of the unknown number. INTEGRAL EQUATION. An equation that does not involve an unknown number in any denominator. LINEAR EQUATION. An equation of the first degree; having one or more unknowns in which no unknown appears in the denominator of a fraction, and in which the sum of the exponents of the unknown in each term is only one. LITERAL EQUATION. An equation in which some or all of the known numbers are represented by letters. NUMERICAL EQUATION. An equation all of whose known numbers are expressed by figures. EQUATION OF CONDITION. See Conditional Equation. EQUATION OF FIRST DEGREE. See simple equation. PURE QUADRATIC EQUATION. An equation in one unknown in which the unknown does not appear in the denominator of a fraction, and in which only the second power of the unknown does appear; i.e. $5x^2 - 37 = 0$ QUADRATIC EQUATION. An equation of the second degree of the unknown number. QUADRATIC EQUATION IN TWO UNKNOWNS. An equation containing one or more terms of the second degree, but no term of higher degree in those unknowns.

RADICAL EQUATION IN ONE UNKNOWN. An equation in which the unknown occurs in a radicand. Same as an irrational equation. RECIPROCAL or RECURRING EQUATION. An equation that remains unaltered when the unknown is changed into its reciprocal and the equation cleared of fractions. Hence, the reciprocal of any root of a reciprocal equation is also a root. The numbers on the right side of the equality sign form the RIGHT SIDE of the equation; the ones on the left side of the equality sign form the LEFT side of the equation. SIMPLE EQUATION. See Linear Equation. A number is said to SATISFY AN EQUATION if, when substituted for the unknown, it reduces the equation to an identity. A value of the unknown which satisfies an equation is called a ROOT OR SOLUTION of the equation.

EQUATIONS. CONTRADICTORY EQUATIONS. Equations in two or more unknowns, which cannot be satisfied by the same values of the unknowns. DEPENDENT EQUATIONS. Equations which can be derived from another equation by some simple arithmetical operation. Two systems of equations are EQUIVALENT when they have the same solution; that is, when every solution of either system is a solution of the other. INCONSISTENT EQUATIONS. Equations that express relations between the unknown quantities that do not satisfy all the equations. INCOMPATIBLE EQUATIONS. See Inconsistent Equations. NON-SIMULTANEOUS EQUATIONS. See Inconsistent equations. INDEPENDENT EQUATIONS. Two or more equations with two or more variable leaving solutions which are not solutions of the other. INDETERMINATE EQUATIONS. Equations having an unlimited number of roots. SIMULTANEOUS EQUATIONS. Independent equations which have a common solution. SYMMETRICAL EQUATIONS. Equations that are not

affected by interchanging the unknown numbers involved. SYSTEM OF EQUATIONS. Two or more equations involving one or more unknowns. That part of mathematics which studies the relations between the coefficients of an equation and its roots, and also many other useful theorems about equations is called the THEORY OF EQUATIONS.

EQUIANGULAR. Having all the angles equal.

EQUILATERAL. Having all the sides equal. (Equilateral polygon, equilateral triangle); see nouns.

EQUIMULTIPLES. Equimultiples of two quantities are the products obtained by multiplying each of them by the same number.

EQUIVALENT. Equal in value; having the same extent, as a triangle and a square of equal area. (Equivalent equations, Equivalent fractions, Equivalent solids, Equivalent surfaces); see nouns.

ERROR. The difference between the observed or approximately determined value and the true value of a quantity.

EUCLID. (365? B. C.) He was a teacher in the University of Alexandria and wrote the first great textbook of geometry known as the "Elements" It contained the first systematic, orderly, and logical arrangement of geometry and was divided into thirteen chapters, called books. The "Elements" contained most of our present plane geometry and some solid geometry.

EUDOXUS (408 - 355 B. C.) He is perhaps the most brilliant mathematician of this period. He has been called the father of scientific astronomical observation. He increased the number of general theorems, added to the three proportions three more and raised to a considerable

quantity of learning, begun by Plato, on the subject of the section, to which he applied the analytical method.

EULER. (1707 - 1783) His father, a minister, gave him his first instruction in mathematics and then sent him to the University of Basel. He wrote one of the most complete and accurate works on the calculus at that time. He also wrote on the subject of analytical mathematics and made researches on the calculus of variations.

EVEN ROOT. See Root.

EVOLUTE OF A CURVE. The locus of the centers of curvature of a given curve.

EVOLUTION. The process of finding any required root of a number or of an expression.

EX-CENTER. See Triangle.

EXERCISE. That which is to be done for the sake of training or improvement.

EXPERIMENT. An act or operation for the prupose of discovering something unknown or testing a principle or supposition.

EXPONENT. An expression written at the right of and above another expression called the base which when positive tells how many times the base is used as a factor. A POSITIVE FRACTIONAL EXPONENT denotes a root of a power. The denominator indicates the root and the numerator the pwer; that is $a^{\frac{r}{s}} = \sqrt[s]{a^r}$

EXPONENTIAL EQUATION. See Equation.

EXPRESSION. A symbol or a combination of symbols serving to express something, as an algebraic quantity. ALGEBRAIC EXPRESSION. A number expressed by literal and arithmetical numbers, connected by

mathematical signs which tell what to do with the numbers. COMPLEX EXPRESSION. See Expression. (Imaginary expression. Compound EXPRESSION.) See Polynomial. FACTORING AN EXPRESSION. The process of finding two or more epxressions whose product is equal to a given expression. FRACTIONAL EXPRESSION. An expression, any term of which is a fraction. IMAGINARY EXPRESSION. An expression containing both real and imaginary terms. INTEGRAL EXPRESSION. An expression which does not have literal numbers in the denominators of fractions. IRRATIONSL EXPRESSION. An expression that contains an irrational number. LINEAR EXPRESSION an expression of the first degree. MIXED EXPRESSION. An expression that consists of one or more integral terms plus or minus one or more fractional terms. SURE EXPRESSION. An expression involving one or more surds.

EXTRANEOUS ROOTS. The roots of an equation C = 0, introduced by the effect of multiplying both members of an integral equation A = B by the same integral function C. Here A, B, and C, represent functions of the unknown or unknowns.

EXTERNALLY. Pertaining to the outer part.

EXTERIOR. The outer surface or part; the outside. (Exterior angle, See Angle.

EXTREME RATIO. See Ratio.

EXTREMES. The first and fourth terms of a proportion.

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FACE ANGLES OF A POLYHEDRAL ANGLE. See Polyhedral Angle.

FACES OF A DIHEDRAL ANGLE. See Dihedral Angle.

FACES OF A POLYHEDRAL ANGLE. See Polyhedral Angle.

FACES OF A POLYGON. See Polygon.

FACTOR. One of two or more numbers, algebraic expressions, or the like, which when multiplied together produce a given product. COMMON FACTOR. An expression that is a factor of two or more expressions. HIGHEST COMMON FACTOR. (H.C.F.) of two or more numbers is the product of all their common factors; each factor taken the least number of times it appears in any expression. LEAST COMMON MULTIPLE. (L.C.M.) of two or more fractions must contain each of the given denominators as an exact divisor. Hence it must contain each FACTOR appearing in the denominators of the given fractions. RATIONALIZING FACTOR. The factor by which a surd expression is multiplied to render the product rational.

FACTOR THEOREM. $(x-a)$ is a factor of $f(x)$ if $f(a) = 0$.

FACTORIAL. The product of an integer by all other smaller integers; as factorial four (written $\underline{4}$ or $4!$) equals 4 x 3 x 2 x 1. a. Related to factors or factorials.

FACTORS. PRIME FACTORS. Numbers that have no factors except themselves and unity.

FACTORING AN EXPRESSION. See Expression.

FERMAT (1601 - 1665) He was a profound scholar in all branches of learning and a mathematician of exceptional powers. He may be regarded as the first inventor of the differential calculus.

FIGURE. Any definite combination of points, lines, surfaces, or solids formed under given conditions. SOLID FIGURE that which has

Length, breadth, and thickness. CURVILINEAR FIGURE. A plane figure bounded by a curve.

FIGURES. CONGRUENT FIGURES. Figures that have the same shape and the same size. EQUAL FIGURES. See CONGRUENT FIGURES. GEOMETRICAL FIGURES. A combination of points, lines, surfaces, or solids, PLANE FIGURES. Figures, all points of which are in the same plane. RECTINLINEAR FIGURES. Plane figures bounded by straight lines. SIMILAR FIGURES, figures that have the same shape.

FINITE. Not too great or too small to be naturally adaptable to measurement.

FINITE SERIES. See Series. FINITE STRAIGHT LINE. See Line.

FIRST. Used as the ordinal of one.

FIRST DEGREE EQUATION. See Equation.

FLUXION. A term used by Newton for his science which is now called the calculus. It also corresponds to the derivative as we now know it.

FOCAL. Of or pertaining to a focus; as, the focal distance (the distance from the center to the principal focus).

FOCAL CHORD. A chord passing through the focus of a conic.

FOCAL RADIUS. A line from the focus of a conic to a point on the curve.

FOCAL WIDTH OR LATUS RECTUM. The focal chord perpendicular to the axis.

FOCI. Plural of focus. The fixed points in the plane of an ellipse or other conic.

FOCUS. One of the points from which the distances to any point of a given curve are in a linear relation. The point when a conic is defined with reference to a fixed line and a fixed point.

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FOOT. A unit of length equivalent to twelve inches; when a straight line is drawn from a point to a line or a plane its intersection with the line or plane is its FOOT.

FORM. Shape, figure, plan. NORMAL FORM. (Also see Normal) $ax^2+bx+c=0$ where a denotes the coefficient of the term in x^2, b the coefficient of the term in x, and c the sum of the terms not containing x, i.e., the sum of the constant terms. QUADRATIC FORM. An expression that contains but two powers of an unknown number of expression, the exponent of one power being twice that of the other.

FORMULA. A rule of computation expressed by means of arithmetical and literal numbers, connected by mathematical signs which tell what must be done with the numbers. BINOMIAL FORMULA. The formula or principal by means of which a binomial to any indicated power may be expanded.

FOURIER. (1768 - 1830) His work marks an epoch in the history of both pure and applied mathematics. It is the source of all modern methods in mathematical physics involving the integration of partial differential equations in problems where the boundry values are fixed. He made the discovery that any arbitrary function (i. e. any graphically given function) of a real variable can be represented by a trigonometric series. He invented important devices for the solution of numerical equations.

FOURTH. Next after the third; the fourth number of four different numbers that form a proportion. (Fourth proportional, Fourth root); see nouns.

A DICTIONARY OF MATHEMATICAL TERMS

FRACTION. Part of unity; one or more of a number of equal parts into which a unit is divided. ALGEBRAIC FRACTION. The indicated division in fractional form of one number by another. CLEARING of FRACTIONS. To change a fractional equation into a new equation that does not contain fractions, multiply every term of the equation by the least common multiple of the denominator. COMPOUND FRACTION. A complex fraction, or a fraction of a fraction. A CONTINUED FRACTION in which the quotients recur is PERIODIC, RECURRING, or continued FRACTION, i.e. $a+\frac{b}{c}+\frac{d}{e}+\cdots$ COMPLEX FRACTION. A fraction in which either numerator or denominator, or both terms, contain fractions. EQUIVALENT FRACTION. Fractions equal in value, having the same extent. IMPROPER FRACTION. A fraction having the numerator greater than the denominator or of equal or greater degree than the denominator. PERIODIC FRACTION. A fraction, when increased, repeats its values for each interval (period).

PROPER FRACTION. A fraction having the numerator less than the denominator. SIMILAR FRACTION. Fractions that have the same denominator.

FRACTIONS. REDUCTION OF FRACTIONS. The process of changing their form without changing their values.

FRACTIONAL EQUATION. See Equation.

FRACTIONAL EXPRESSION. See Expression.

FRET. A design which keeps repeating itself.

FREEHOLD ESTATE. An estate which yields a perpetual annuity.

FRUSTUM. The part of a solid left after cuttinfoff a top portion by a plane parallel to the base. ALTITUDE OF A FRUSTUM OF A CONE. The perpendicular distance between the bases. BASE OF FRUSTUM. That section made by the plane. CIRCUMSCRIBED FRUSTUM. A frustum of a

pyramid is CIRCUMSCRIBED about a frustum of a cone when the bases of the frustum of the pyramid are circumscribed about the bases of the frustum of the cone. HEIGHT OF FRUSTUM. See ALTITUDE. THE SLANT HEIGHT OF THE FRUSTUM. That part of the slant height included between the bases of the frustum.

FLUCRUM. The support, or point of rest, on which a lever turns in moving a body.

FUNDAMENTAL LAWS OF MULTIPLICATION. The 'law of order'or the Commutative Law, 'law of grouping' or the Associative Law, 'Law of operators or the 'Distributing law'.

FUNCTION. When two variables are so related that the value of the first depends on that of the second, then the first variable is said to be a function of the second varialbe. ALGEBRAIC FUNCTION. A number whose dependence on another number is expressed in algebra symbols. DEVELOP A FUNCTION. See Develop. LINEAR FUNCTION. The function $ax+b$ is a function of the FIRST DEGREE in X. It is also a LINEAR FUNCTION of X, because the graph is a straight line. FUNCTION OF THE SECOND DEGREE. The expression $x^2-34x+145$ is called a QUADRATIC FUNCTION of X, or a function of the SECOND DEGREE. PERIODIC FUNCTION. If the independent variable increases or decreases indefinitely and the dependent variable repeats its values for each period of the independent variable, the dependent varialbe is said to be a periodic function. For example if $y = \sin x$ then y or $\sin x$ is a periodic function. A RATIONAL INTEGRAL FUNCTION of X is one that can be put in the form $Ax^n+Bx^{n-1}+Cx^{n-2}+\cdots$ in which n is a positive whole number, and $A+B+C+\cdots+F$, , denote any expressions not containing X. TRIGONOMETRIC FUNCTION are trigonmetric ratios or any combination of these ratios.

A DICTIONARY OF MATHEMATICAL TERMS

GAUCHE. Skew; not plane. Not perfectly symmetrical (Gauche lines,): see noun.

GAUSS (1777 - 1855 A. D.) He was the son of a bricklayer and had a marvellous aptitude for calculation. Higher arithmetic was his favorite study. The solution of the problem of the representation of numbers by binary quadratic forms is one of the greatest achievements of Gauss. Some of his papers on the theory of numbers were not published until after his death. When nineteen years of age, he proved that a regular polygon of 17 sides could be inscribed in a circle.

GENERAL ENUNCIATION. Statement; consists of an hypothesis and a conclusion. (General number, general problem); see nouns.

GENERATE. A line is conceived to assume in succession the position of every one of a system of lines on a given surface, and in so doing, passes through every point of the surface and through no other points.

GENERATRIX. A line which generates a surface. See conical surface. See Cylindrical Surface.

GEOMETRIC. According to the principles of geometry. (Geometric figure, geometric line, geometric locus, geometric magnitude, geometric means, geometric points, geometric proposition, geometric solids, geometric surface); see nouns.

GEOMETRICAL FIGURE. See Figure.

GEOMETRICAL PROGRESSION. See Progression.

GEOMETRY. That branch of mathematics which treats of magnitude, position and form. ANALYTIC GEOMETRY. The chief features of analytic geometry which distinguish it from elementary geometry are its methods and its results. These methods consist of indcating by Algebra symbols

the positon of a point either fixed or in motion, and then applying to these symbols the processes of algebra. Geometry treated by means of the use of algebra and trigonometry with reference, direct or indirect, to a system of coordinates. The analysis of geometrical concepts by a study of the corresponding equations. DESCRIPTIVE GEOMETRY. The science of making projections of any accurately defined figure such that from them can be deducted not only its projective, but also its metrical properties. PLANE GEOMETRY. The geometry of figures whose parts all lie in one plane. SOLID GEOMETRY. The geometry of solid figures; GEOMETRY OF THREE DIMENSIONS. GEOMETRY OF SPACE treats of figures all points of which are not in the same plane.

GOLDEN SECTION. See Section.

GRAM. A unit of weight. It is equal to the weight of a cubic centimeter of distilled water at its greatest density.

GRAPH. A curve representing an equation or a function. To draw or plot (a curve) from its equation or function. BAR GRAPH. A graph made up of parallel bars. BROKEN-LINE GRAPH. Each dot of the graph is connected with the next one by a straight line. The complete line is a broken line. CIRCULAR GRAPH. Sometimes called a Pie Diagram. A graph in the form of a circle which shows the distribution in sectors. DISTRIBUTION-LINE GRAPH. This graph shows the relation of parts to a whole and to each other. SMOOTH-LINE GRAPH. The points are connected by a smooth curved line. RECTANGULAR GRAPH. This graph is a form of the distribution graph.

GRAPH PAPER. See Paper.

A DICTIONARY OR MATHEMATICAL TERMS

GRAPH OF AN EQUATION WITH TWO VARIABLES. See Equation.

GRAPH OF A NUMBER. See Number.

GRAPHICAL SOLUTION. See Solution.

GRAPHICAL REPRESENTATION. The representation of statistics and of mathematical functions by means of graphs.

GRAVITY. Force of attraction inherent in all matter. Gravity = g; SPECIFIC GRAVITY. Force of attraction exorted by the earth on unit mass at the surface of the earth. Also; see Specific.

GROUPING. Being placed in groups. The LAW OF GROUPING is the product of several numbers is the same in whatever manner they are grouped. THE SYMBOLS OF GROUPING are the BRACKETS [ ], BRACES { }, and the viniculums.

GREAT CIRCLE. See Circle.

GREAT CIRCLE OF SPHERE. See Sphere.

GREATEST COMMON DENOMINATOR. See Denominator.

HARMONIC POINTS. See Points.

HARMONICALLY. A line divided internally and externally into segments having the same ratio.

HEIGHT. See Altitude. (slant height of cone, slant height of frustum, slant height of pyramid); see nouns.

HELIX. A curve traced on a right circular cylinder so as to cut all the elements of the cylinder at the same angle.

HEMISPHERE. Half of a sphere.

HEPTAGON. A plane figure having seven angles and seven faces.

HERON. (About 100 B. C.) He was celebrated for his ingenious mechanical inventions such as the hydraulic organ, the water-clock, etc. It is believed that he invented the important formula for finding the area of a triangle expressed in terms of its sides.

HEXAGON. A plane figure having six angles and six sides.

HEXAHEDRON. A solid figure having six faces.

HIGHER EQUATION. See Equation.

HIGHEST COMMON DENOMINATOR. See Denominator.

HIGHEST COMMON FACTOR. See Factor.

HIPPARCHUS (about 140 B. C.) He was the greatest astronomer of antiquity. He was interested in mathematics only as an aid to astronomical inquiry. He originated the science of trigonometry and calculated a "Table of chords" in twelve books.

HIPPIAS (460 - ? B. C.) He was a contemporary of Socrates. He is the inventor of a transcendental curve which served to divide an angle not only into three, but into any number of equal parts. This curve is called the quadratrix.

A DICTIONARY OF MATHEMATICAL TERMS

HIPPOCRATES (430? B. C.) He was a talented mathematician but, having been defrauded of his property, he was pronounced slow and stupid. In his study of the quadrature and duplication-problems, he contributed much to the geometry of the circle. The subject of similar figures, as developed by Hippocrates, involved the theory of proportions.

HOMOGENEOUS. Of the same kind and commensurable, also, of the same degree or dimensions.

HOMOLOGOUS Having the same or a similar relation; corresponding, as in relative position, proportion, value, or structure. (Homologous angles, homologus lines, homologous sides); see nouns.

HORNERS' METHOD OF SOLVING NUMERICAL EQUATIONS. By this method any real root is obtained, after its situation has been approximately determined. The main principle involved is the successive diminution of the roots of the given equation by known quantities.

HYPERBOLA. A curve consisting of two distinct and similar branches formed by a section of a cone, when the cutting plane makes a greater angle with the base then the cones' side makes.

HYPOCYCLOID. A curve traced by a point of a circle that rolls on the inside of a fixed circle.

HYPOTENUSE. The side of a right-angled triangle opposite the right angle.

HYPOTHESIS. (Hyp.) A statement which is assumed to be true.

A DICTIONARY OF MATHEMATICAL TERMS

ICOSAHEDRON. A solid figure having twenty faces.

IDENTICAL EQUATIONS. See Equations.

IDENTICALLY EQUAL. See Equal.

IDENTITY. Sameness in nature or qualities; likeness, exact. An equation that is true for all values of the letters in it. See IDENTICAL EQUATION.

IMAGINARY. Pertaining to a quantity or expression involving an even root of a negative quantity. PURE IMAGINARY. In the system of numbers of the form $a+bi$, where a and b are real numbers and i is a symbol whose square is -1, when $a = 0$ they are called pure imaginary numbers.

IMAGINARY EXPRESSION. See Expression. IMMAGINARY NUMBER. See Number. IMAGINARY UNIT. See Unit.

IMPOSSIBLE EQUATION. See Equation.

IMPROPER FRACTION. See Fraction.

INCENTER. See Triangle.

INCH. A measure of length, the twelfth part of a foot, or 2.54 centimeters. SQUARE INCH. See Square.

INCOMPATIBLE. See Equation.

INCOMPLETE. Unfinished. See INCOMPLETE QUADRATIC.

INCOMMENSURABLE. Having no common measure or standard ov comparison, having no common divisor except unity.

INCOMMENSURABLE RATIO. See Ratio.

INCLINATION. The mutual approach of two lines or planes that tend to meet and form an angle ('angle of inclination'); also, the difference of direction of the lines or planes as measured by the angle.

A DICTIONARY OF MATHEMATICAL TERMS

INCLUDED ANGLE. See Angle.

INCONSISTENT EQUATION. See Equation.

INCREMENT. A small increase (positive or negative) in an independent variable, or the increase of a function due to this. Also, a change, either positive or negative, in the value of an independent variable; also, the corresponding change in the value of the dependent function. The increment of a variable in changeing from one numerical value to another is the difference found by subtracting the first value from the second. An increment of X is denoted by the symbol Δx, read delta X.

INDEPENDENT. A quantity or function, not depending upon another for value is said to be independent. (Independent equations, independent numbers, independent variables); see nouns.

INDETERMINATE. Having an indefinite number of solutions or where value is not evident. (Indeterminate equation, indeterminate problem); see nouns.

INDETERMINATE FORMS. When, for a particular value of the independent variable, a function takes on one of the forms $\frac{0}{0}$, $\frac{\alpha}{\alpha}$, $0 \cdot \alpha$, $\alpha - \alpha$, 0^0, α^0, 1^∞, it is said to be indeterminate. For example $y = \frac{x^2-1}{x-1}$ is indeterminate for $x = 1$.

INDEX. An exponent. INDEX LAW OF MULTIPLICATION. See Multiplication. (Index of a power, Index of a root); See nouns.

INDIRECT MEASURE. See Measure.

INDIRECT METHOD OF PROOF. This method consists in showing that a given hypothesis must lead to one of two or more conclusions; and then

if all but one of these conclusions are proved impossible, the remaining one is the correct conclusion.

INEQUALITY. An expression of two unequal quantities connected by either of the signs of inequality $>$ or $<$, (as, a $>$ b, 'a is greater than b' a $<$ b, 'a is less than b'). A RATIO OF GREATER INEQUALITY is a ratio in which the antecedent is greater than the consequent. A ratio of less inequality is a ratio in which the antecedent is less than the consequent.

INFINITESIMAL. A variable v whose limit is zero is called an infinitesimal.

INFINITE. Greater than any assignable quantity of the same kind. Unlimited or boundless in time or space. (Infinite convergent series, Infinite geometric series, Infinite series); see Series.

INFINITY. Infinite distance, magnitude or an infinitely distant part of space. Alg. If a variable v , ultimately becomes and remains in numerical value greater than any assigned positive number however large, we say V , is numerical value, increases without limit, or V becomes infinitely great and write limit $v = \infty$ or $V = \infty$ or $V \to \infty$. The symbol ∞ (Infinity) does not represent a number; it simply seems to characterize a particular mode of variation.

INFLECTION, POINTS OF. Points on a curve which separate arcs concave upwards from arcs concave downwards.

INITIAL LINE OF AN ANGLE. The rotating radius, which generates the angle, in its first position.

INITIAL. First in order or importance. INITIAL SIDE. The first side in enumeration or development.

A DICTIONARY OF MATHEMATICAL TERMS

INSCRIBE. To draw or delineate one figure within another figure so that the inner lies in the boundary of the outer at as many points as possible. INSCRIBED ANGLE An angle whose vertex is on the circle and whose sides are chords. INSCRIBED CIRCLE. See Circumscribed Polygon.

INSCRIPTIBLE. Capable of being inscribed in. See Circumscriptich.

INTEGER. A whole number. Whole number that differ by one, like 9, 10, 11, or -8, -7, -6, are CONSECUTIVE INTEGERS. CONSECUTIVE EVEN INTEGERS, like 2, 4, 6, or -8, -6, -4, differ by 2, that is, each integer is two larger than the preceeding one. CONSECUTIVE ODD INTEGERS, like 3, 5, 7, or -3, -1, 1, also differ by 2.

INTEGRAL. Pertaining to or being an integer; not fractional; also, pertaining to or involving integrals (as, integral calculus. The inverse of the derivative. The required function of the given derivative. The result of an integration of a function or of an equation; an expression whose derivative is the integrand. For example, if $u = \int u\,dx$, u is said to be the integral of u with respect to x where u is called the integrand. Also u is the derivative of u with respect to x and may be expressed $\frac{dy}{dx} = u$.

INTEGRATION. The process of finding the function or integral of a given derivative.

INTEREST. Money paid for the use of money at a given rate per centum per year of the sum borrowed.

INTERIOR Pertaining to the inside.

INTERNALLY. See Interior.

A DICTIONARY OF MATHEMATICAL TERMS

INTERPOLATE. To insert or find intermediate terms in as of a series according to the law of the series.

INTERPOLATION. The method or operation of finding from a few given terms of a series, other terms in conformity with the law of the series. For example the method for finding the logarithms of a number not given directly in the table. A special process of finding approximately the values of the required sines, cosines, tangents, etc.

INTERSECTION. The point, line, or curve, where one line, or curve, plane, or surface, cuts another.

INVERSE. Turned upside down. The direct opposite. INVERSE RATIO. See Ratio.

INVERSE FUNCTIONS. The equation $y = f(x)$ defines x implicity as a function of y. When solved for x it takes the form $x = \phi(y)$. The function $\phi(y)$ is called the inverse of the direct function $f(x)$. For example. $y = \sin x$ and $x = \sin y$.

INVERSION. Reversal of position, direction, order, or relation; something inverted.

INVOLUTE. A curve traced by any point of a perfectly flexible inextensible thread kept taut as it is wound upon, or unwound from, another curve.

INVOLUTION. The raising of a quantity or expression to any given power.

IRRATIONAL. Not capable of being exactly expressed by an integer, rational, or fraction; or surd. (Irrational equation, irrational expression, irrational number); see nouns.

ISOCELES TRAPEZOID. See Trapezoid.

ISOCELES TRIANGLE. See Triangle.

ISOLATED POINT. If the tangents at a double point are imaginary, the point is called an isolated point or a conjugate point. There is no other portion of the curve in its vicinity.

ISOPERIMETRICAL. Equal in perimeter. A figure equal in perimeter to another.

A DICTIONARY OF MATHEMATICAL TERMS

LAGRANGE (1736-1813) He was one of the greatest mathematicians of all times. He enriched algebra by researches on the solution of equations. He wrote much on differential equations. He published his theory of analytic functions, where he strove to give a precise foundation to analysis. He was also a great astronomer and physcist.

LAMBERT. (1728-1777) He was the son of a poor tailor and acquired through his own unaided efforts a knowledge of elementary mathematics. He proved that π is not a rational. He elaborated the subject of hyperbolic functions. In 1700 he published a 7 - place table of natural logarithms for numbers 1 - 100.

LAPLACE (1749 - 1827) He looked upon mathematics as the tool for the solution of physical problems. He was a most sagacious and profound scientist. He did more to advancing the subject of the theory of probability than any other investigator. He also made discoveries in determinants, differential equations, and solving equations of the second, third, and fourth degrees.

LATERAL. Of or pertaining to the side.

LATERAL AREA. The area of the lateral surface.

LATERAL AREA OF A PRISM. See Prism.

LATERAL EDGES. The intersection of the lateral faces.

LATERAL FACES. The side faces of a figure.

LATERAL FACES OF A PYRAMID. See Pyramid.

LATERAL SURFACES. The surface pertaining to the side of a figure.

LATERAL SURFACE OF A CONE. See Cone.

LATUS RECTUM. See Parameter.

A DICTIONARY OF MATHEMATICAL TERMS

LAW. A mathematical rule on which something, as the construction of a curve, depends. ASSOCIATIVE LAW. The law concering methods of grouping. This law is applied to additional and states that addends may be grouped in any manner. COMMUTATIVE LAW. The law concerning the order of mathematical processes. In addition the value of a sum remains unchanged by changing the order of the addends. DISTRIBUTIVE LAW. The Law concerning operations either upon the whole or upon every part. The product of a polynomial and a monomial is the algebraic sum of the products obtained by multiplying each term of the polynomial by the monomial. This is also called the rule of multiplication. (Law of cosines, law of order, law of sines, law of tangents); see nouns.

LEGENDRE. (1752 - 1833) As an analyst, second only to Laplace and J. Lagrange, Legendre enriched mathematics by important contributions, mainly on elliptic integrals, theory of numbers, attraction of ellipsoids, and least squares.

LEGS OF A RIGHT TRIANGLE. See Triangle.

LEBNITZ (1646 - 1716) His remarkable abilities were shown by original investigation in several branches of learning. He was first to publish his discoveries in calculus in a short essay appearing in the periodical "Acta Eruditorum" at Leipzig in 1684. It is known, however, that manuscripts on Fluxions written by Newton were already in existence, and from these some claim Leibnitz got his new ideas. The decision of modern times seems to be that both Newton & Leibnitz invented the Calculus independently of each other.

A DICTIONARY OF MATHEMATICAL TERMS

LEMMA. An auxiliary theorem used in demonstrating some other theorem.

LEVER. A bar or rigid piece acted upon at different points by two forces, as a voluntarily applied force (thepower) and a resisting force (the weight), which severally tend to rotate it, in opposite directions about a fixed axis or support (the fulcrum).

LEVERAGE. The mechanical advantage or power gained by using a lever; when several weights are balanced on a lever, the product of any weight by its distance from the fulcrum is called the LEVERAGE of moment of the weight. LEVERAGE OF A FORCE. The perpendicular distance from the line in which the forde acts upon a body to a point about which the body is supposed to turn.

LIKE. Of the same form, appearance. LIKE SURDS. See Surds.

LIMIT. That which terminates, circumscribes, or confines; bound. If a variable takes on successively a series of values which approach nearer and nearer to a constant value in such a way that the difference between the variable and the constant becomes and remains less than any assigned value however small then the constant is said to be the limit of the variable.

LINE. A continuous extent of length, straight or curved, without breadth or thickness; the trace of a moving point; also, a circle of the terrestrial or of the celestial sphere (as the equinoctial line). A point, a line, or a plane that divides a line into two equal parts is a BISECTOR OF THE LINE. A BROKEN LINE is composed of segments of straight lines. A CLOSED LINE is one that can be traced by pencil from any point

around to the same point without removing the pencil from the line or passing over any portion of the line a second time. A CURVED LINE, or a CURVE, changes its direction at every point. If a given line - segment A B is divided at C, a point between A and B, it is said to be DIVIDED INTERNALLY into the two segments AC and CB

A ——— C B ——— C'

If the point C is on the line AB but not between A and B, as at C', the line-segment is DIVIDED EXTERNALLY at C' into the two segments AC' and C'B. GEOMETRIC LINE. See Line. INITIAL LINE. See Initial. HORIZON LINE. Eye level. MEDIAL LINE. See Median. OBLIQUE LINE. See Oblique. A LINE and a PLANE or two PLANES that never meet however far produced are said to be PARALLEL. STRAIGHT LINE. The intersection of two plane surfaces. A LINE or a plane is TANGENT to a sphere if it has but one point in common with the sphere. TERMINAL line. See Terminal. VERTICAL LINE or PLUMB LINE. The line along which a string hangs when suspended from one end and weighted at the other.

LINES. BUNDLE OF LINES. The totality of lines through any point P (center) of space. CONCURRENT LINES. Two or more lines passing through the same point. CORRESPONDING LINES. Those lines in similar figures that are similarly situated with respect to the same or equal angles. Lines that are similarly related by enumeration, projection, or sections, etc. FINITE STRAIGHT LINES. Straight lines contained between two definite points which are the ends. GAUCHE LINES. Two

lines so related that no plane contains both lines. HOMOLOGOUS LINES. See CORRESPONDING LINES. INDEFINITE STRAIGHT LINES. Straight lines extending without end in both directions. PARALLEL LINES. Lines in the same plane which never intersect. A PENCIL OF LINES. Any number of lines which can be passed through a point. SKEW LINES. Two lines that are not parallel and that do not intersect if prolonged. A straight line that cuts two or more straight lines is called a TRANSVERSAL of those lines.

LINES OF CENTERS. See Centers.

LINE OF SYMMETRY. See Symmetry.

LINE-SEGMENT. The definite portion between two points which may limit a line. See Segment. THE BISECTOR OF A LINE-SEGMENT divides it into two equal parts. The ORTHOGONAL PROJECTION OF A LINE-SEGMENT upon a given line is the part of the line between the feet of the perpendiculars drawn from the extremities of the line-segment to the given line.

LINEAR. Pertaining to a line or lines. (Linear eccentricity, linear equation, linear expression, linear function); see nouns.

LITERAL. Pertaining to the letters of the alphabet. (Literal equation, literal number); see nouns.

LOBACHEVSKI (1793 - 1856 A. D.) He was a professor at the University of Kasan, Russia. He published a paper entitled "New Elements of Geometry, with a Complete Theory of Parallels," which attracted little notice until a similar system of geometry was deduced independently by the Bolyais in Hungary, who called it "Absolute geometry." This geometry was

based upon the postulate "Through a given point there can be any number of parallels to a given line."

LOCI. Plural of locus.

LOCUS. A curve or other figure considered as generated by an element such as a moving point, line, or surface; the place or position of all the elements and of only those elements which satisfy a given condition.

LOGARITHM. The exponent or that power to which a fixed number (the base) must be raised in order to produce a given number (the antilogarithm). In the COMMON (or DECIMAL) or BRIGGSIAN SYSTEM of logarithms, the base is 10. This system is used almost exclusively when logarithms are employed to facilitate numerical computations. the NAPIERIAN SYSTEM OF LOGARITHMS is used for analytical purposes only; its base is 2.71828. See Modulus. The symbol for the Napierian base is e. The logarithms of all positive numbers to any given base constitutes a SYSTEM OF LOGARITHMS.

LOGARITHEMIC SCALE. See Scale.

LOWER NAPPES. See Nappes.

LOWEST COMMON DENOMINATOR. See Denominator.

LOWEST COMMON FACTOR. See Factor.

LOWEST COMMON MULTIPLE. See Multiple.

LUNE A portion of the surface of a sphere bounded by two great semicircles. The spherical angle formed by its bounding semicircles is the ANGLE OF THE LUNE.

A DICTIONARY OF MATHEMATICAL TERMS

MAGNITUDE. Size; also, amount, extent, or the like. That which is conceived of as measurable; the extended quantity of a line, surface, or solid; length, area, or volume. The MAGNITUDE of SIZE OF AN ANGLE depends upon the difference in direction of the rays; it is the amount of turning necessary to rotate a ray from its initial position to its final position. MAGNITUDES of the same kind are magnitudes that can be expressed in terms of a common UNIT OF MEASURE. The NUMERICAL VALUE OF A MAGNITUDE is the number of times it contains the unit of measure. (COMMENSURABLE MAGNITUDES, See Commensurable. INCOMMENSURABLE MAGNITUDES, See Incommensurable.) The RATIO OF TWO MAGNITUDES of the same kind is the quotient of their numerical values.

MAJOR ARC. See Arc.

MAJOR ARC OF CIRCLE. See Circle.

MAJOR AXIS OF CIRCLE. See Circle.

MANTISSA. The decimal part of the logarithm.

MEAN PROPORTIONAL, See Proportional.

MEAN RATIO See Ratio.

MEANS, The second and third terms of a proportion. When three terms form an arithmetical progression, the middle term is the ARITHMETICAL MEAN between the other two. The GEOMETRIC MEANS between two numbers are numbers that form a geometric progression when inserted between the given numbers.

MEASURE. The process of finding how many times a quantity contains some other quantity of the same kind taken as a unit, or standard of comparison, called the UNIT OF MEASURE. The number which shows the number of

times a quantity contains the unit of measure is the NUMERICAL MEASURE of that quantity. (Measure of an arc, measure of an angle); see nouns.

MEASUREMENT. The act of measuring. INDIRECT MEASUREMENT. When it is impossible to determine distances or angles by direct measurement other related lines or angles may be measured which will enable one to determine the required part.

MEDIAL. Pertaining to the middle.

MEDIAL LINE. It is a line segment of a triangle from any vertex to the middle point of the opposit side.

MEDIAN. Pertaining to the middle; pertaining to a plane dividing something into two equal parts. The middle term of a series when arranged according to magnitude. (Median of triangle, median of trapezoid); see nouns.

MEDIAN SCORE. A score, grade, or value midway between a series of scores, grades or values when arranged according to magnitude.

MEMBER. Either side of an algebraic equation. RIGHT AND LEFT MEMBER. The right and left sides of an equation.

METER. In the metric system, the fundamental unit of length; equivalent to 39.37 inches. Origionally defined as one ten-millionth of the distance on the earth's surface from the pole to the equator.

METHOD. A mode of procedure. HORNERS' METHOD. See Horner's. Hindu Method. See Hindu. INDIRECT METHOD. See Indirect. SUB-SUBSTITUTION METHOD. See Substitution.

A DICTIONARY OF MATHEMATICAL TERMS

METRIC SYSTEM. A decimal system of measures and weights, of which the meter is one of the fundamental units.

MIDPOINT. The point in the middle. (Mid-point of prismatoid, mid-point of segment); see nouns.

MINIMUM. The least quantity or amount possible, allowable; the lowest amount, value. MINIMUM POINT. See Point.

MINOR ARC. See Arc. MINOR ARC OF CIRCLE. See Circle.

MINOR AXIS. See Ellipse.

MINUEND. The number or quantity from which another (the subtrahend) is to be deducted in the operation of subtraction.

MISTAKE. To conceive of or understand wrongly; to take wrongly. Inacuracies caused by carelessness or ignorance.

MIXED. Composed of different constituents or elements. (Mixed expression, mixed number, mixed surd); see nouns.

MODULUS. The word modulus has at least three distinct meanings in mathematics. In logarithms it is the factor used to make the logarithm of a number to a certain base equivalent to the logarithm of the same number to a different base. For example in $\log_a A = \frac{1}{\log_b a} \log_b A$. $\frac{1}{\log_b a}$ is called the modulus. In complex numbers. The modulus of the number $a+bi$ is the positive value of $\sqrt{a^2+b^2}$. In the theory of numbers. If $a-b = gm$. That is if $(a-b) \div m = g$ it is written $a \equiv b \mod m$ and is read, a is congruent to b to the modulus or (moduls) m.

MOVEMENT. See Leverage.

MONOMIAL. Consisting of one term only. TO SQUARE A MONOMIAL, square its numerical coefficient, and multiply the result by each

of the literal factors of the monomial, giving each letter twice its original exponent.

MOTION. The process of moving or changing place or position; power of movement, as of a body. UNIFORM MOTION. An object traveling in equal time - intervals over equal distances.

MULTIPLE. A number which contains another number some number of times without a remainder; the multiple of a number is a number that is exactly divisible by it. A COMMON MULTIPLE of two or more numbers is a number that is exactly divisible by each of them. The LOWEST COMMON MULTIPLE (L. C. M.) of two or more numbers is the smallest of their common multiples.

MULTIPLICAND. The number to be multiplied by another number taken as an addend as many times as there are units in the multiplier.

MULTIPLICATION. The process of finding the quantity (the product) resulting from the addition of a given quantity (the multiplicand) taken as many times as there are units in another given quantity (the multiplier). ASSOCIATIVE LAW OF MULTIPLICATION. A(bc) = (ab) C. The result of multiplying "a" by the product "bc" is the same as that of multiplying the product "ab" by "c". The DISTRIBUTIVE LAW OF MULTIPLICATION of Algebra, which asserts that $a(x+y) = ax + ay$ in the geometric form, is the rectangle of two given lines equals the sum of the rectangles contained by one of them and the several segments into which the other is divided. THE INDEX LAW in multiplication is: $a^m + a^n = a^{m+n}$.

MULTIPLIER. The number by which another is to be multiplied. See Multiplication. NEGATIVE MULTIPLIER. The negative multiplier is to be

considered the same as a positive multiplier except that the product is to have the opposit quality from what it would be if the multiplier were positive.

MUTUALLY. Having the same relation each toward the other or others.

A DICTIONARY OF MATHEMATICAL TERMS

NAPIERIAN SYSTEM OF LOGARITHMS. See Logarithms.

NAPPES. The two parts of the pyramidal surface on opposite sides of the fixed point. The two parts of a complete conical surface are NAPPES OF THE CONE. If the generatrix of a conical surface is of indefinite length, the surface consists of two portions, one above and the other below the vertex, which are called the UPPER and LOWER NAPPES, respectively.

NATURAL SYSTEM OF LOGARITHMS. See Logarithms.

NEGATIVE. The sign, -, is used with numbers, or their symbols, to denote their quality, or the quality of the quantities which they represent.

NEGATIVE MULTIPLIER. See Multiplier.

NEGATIVE NUMBER. See Number.

NEGATIVE QUANTITY. See Quantity.

NEGATIVE TERM. See Term.

NEWTON (1642 - 1727) He was the foremost English expounder of applied mathematics. In mathematics his genius perhaps is best shown by the fact that he not only discovered the law of gravitation, but invented the differential calculus by which to discuss the facts involved. But just how the honors for the discovery of this powerful means of investigating mathematical problems are to be shared between Newton & Leibniz is a question which has perhaps not even yet been satisfactorily answered.

NODE. A double point of a curve where the tangents at this point are real and different.

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NON-SIMULTANEOUS EQUATION. See Equation.

NORMAL. The line which is perpendicular to a tangent line of a curve or tangent plane of a surface at the point of contact is the normal to the curve at that point. NORMAL FORM see FORM.

NOTATION. The representation in algebraic symbols of the unknown numbers of the problem. ALGEBRAIC NOTATION A method of expressing numbers and figures by letter.

NUMBER. A word or symbol, or a combination of words or symbols, used in counting or to denote a total. ABSTRACT NUMBER. A number considered a part from the objects enumerated. ARITHMETICAL NUMBER the measure of one quantity in terms of another as a unit. It has the quality of a positive or a negative quantity. COMPLEX NUMBERS. An expression like $a+bi$, formed by connecting a real number, a with a pure imaginary, bi, by the sign $+$. They are also often called imaginary numbers. CONJUGATE COMPLEX NUMBER complex numbers which differ in the sign of the imaginary term. DECIMAL NUMBER Pertaining to the number ten, or tenths. Figures written to the right of the decimal point. GENERAL NUMBER. A letter or other number symbol that may represent any number. IMAGINARY NUMBER. An indicated root of a negative number. INDEPENDENT NUMBER. The number on which the function depends. INTEGRAL NUMBER. A number no part of which is a fraction. IRRATIONAL NUMBER. A number which cannot be expressed wholly in rational form. Those numbers that cannot be expreesed exactly as quotients of integers, as $\sqrt{2}$, $\sqrt{\frac{1}{3}}$, $\sqrt[3]{7}$. KNOWN NUMBER. A general number or one whose value is known. LITERAL NUMBER. A letter denoting a number.

MIXED NUMBER. A number one part of which is integral and the other part fractional. NEGATIVE NUMBER. A number less than zero. PRIME NUMBER. A number which has no factors except itself and unity. PURE IMAGINARY NUMBER. An imaginary number of the form $\sqrt{-a}$. RATIONAL NUMBER. A positive or negative integer, or a fraction whose terms are integers. REAL NUMBER. A number that does not involve an even root of a negative number. (Rational and irrationalnumbers are REAL NUMBERS). UNKNOWN NUMBER. A number whose value is to be found. WHOLE NUMBER. A unit or an aggregate of units.

NUMBERS. ALGEBRAIC NUMBERS. Functions whose dependence on other functions is expressed in algebraic symbols. COMPOUND NUMBERS. A quantity expressed in more than one denominator or unit. DECIMAL NUMBERS. See Decimal. DIRECTED NUMBERS. Or signed numbers are numbers whose units are positive or negative. NEGATIVE NUMBERS are algebrically the less, the greater their arithmetical values. POSITIVE NUMBERS, numbers greater than zero. SIGNED NUMBERS. Positive and negative numbers are such numbers since each consists of a numerical part, together with a sign of quality expressed or understood.

NUMBER SCALE. See Scale.

NUMERATOR. That term (usually written above the line) of a fraction which shows how many parts of a unit are taken.

NUMERICAL COEFFICIENT. See Coefficient.

NUMERICAL DICTIONARY. A dictionary enabling one to find numerical values, the trigonometrical ratios of any required angle.

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NUMERICAL EQUATION. See Equation.

NUMERICAL EXPRESSION. See Expression.

NUMERICAL FORM. See Form.

NUMERICAL MEASURE. See Measure.

NUMERICAL VALUE. See Value.

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OBLIQUE. Neither perpendicular to nor parallel with a given line or surface; slanting; sloping. OBLIQUE ANGLES are acute and obtuse angles. OBLIQUE CYLINDER. A cylinder whose elements are oblique to the bases. If a line intersects a plane and is not perpendicular to it, it is OBLIQUE to the plane. A PRISM IS OBLIQUE if its lateral edges are oblique to the bases. OBLIQUE COORDINATES. See Coordinates.

OBTUSE. Blunt in form; not sharp or acute; rounded at the extremity. OBTUSE ANGLE. An angle greater than a right angle but less than a straight angle. OBTUSE TRIANGLE. A triangle one of whose angles is obtuse.

OCTAGON. A polygon of eight sides.

ODD ROOT. See Root.

OPERATION. The action of working upon a quantity so as to change its value or form (as in addition, subtraction, etc.) to derive some other quantity from it (as in extracting the cube root), or to arrive at some other result. (SIGNS OF OPERATION. + (read plus), - (read minus), X (read multiplied by, ÷ (read divided by), are used in algebra to denote algebraic addition, subtraction, multiplication, and division, respectively.

OPPOSITE. Tending or going the other way, or counter to another or each other; contrary. (Opposite angles, opposite points, opposite quantities, opposite qualities, opposite spherical triangle); see nouns.

OPPOSING QUALITIES. See Qualities.

OPPOSITION. The act of placing opposite; SIGNS OF OPPOSITION. See signs of Quality.

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ORDER. Sequence or position. The order of a radical or of a surd is indicated by the index of the root or by the denominator of the fractional exponent. ORDER OF INEQUALITY. See Inequality. LAW OF ORDER. The value of a sum of positive and negative numbers is the same whatever the order of the addends.

ORDINAL. Denoting position in a series, as first, second, etc.

ORDINATE. Any of a set of parallel chords drawn at an angle to the axis of abscissas and bisected by it. The ORDINATE OF A POINT. The length of the segment of the ordinate through the point from the point and the axis of abscissas. The perpendicular distance of any point from the X - axis is its rectangular. ORDINATE. See also Coordinate.

ORIGIN. The point O, where the axes intersect.

ORTHOCENTER. The common intersection point of the straight lines through the three vertices of a triangle perpendicular to the opposite sides. ORTHOCENTER OF TRIANGLE. See Triangle.

OSCULATION, POINT OF. The singular point of tangency when the curve recedes from the tangent in both directions.

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PANTOGRAPH. An instrument used in drawing figures to definite scale, and to enlarge or to reduce maps, drawings, designs, etc.

PAPER. A material used for writing, printing, etc. GRAPH PAPER. A paper ruled very accurately into small squares, parallelograms, concentric circles, or other figures.

PARBOLA. A plane curve formed by the intersection of a cone with a plane parallel to an element of the cone. It is also defined in terms of distances from a fixed point and a fixed line.

PARBOLIC. Pertaining to, resemblin a parabola.

PARAMETER, OR ARBITRARY CONSTANT. A constant to which any one of an unlimited set of numerical values may be assigned but this value once assigned is retained for any simple investigation.

PARAMETRIC EQUATIONS OF THE CURVE. If the equation of a curve is expressed in terms of two variables x and y and if in turn one of these variables say x is expressed in terms of a third variable t_1, called a parameter, then because of the relationship of x and y, y also may be expressed in terms of t_1. These expressed relationships between x and t and y and t are called parametric equations of the curve, an example $\begin{cases} x = f(t) \\ y = \phi(t) \end{cases}$.

PARALLEL. Of lines (straight or curved), planes, or curved surfaces, so placed one beside another as to be equidistant at all corresponding points. See Lines.

PARALLEL POSTULATE. See Postulate.

PARALLELS. Plural of PARALLEL. AXIOM OF PARALLELS. Through a point without a line, one and only one line can be drawn parallel to the given line.

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PARALLELOPIPED. A prism whose bases are parallelograms. RIGHT PARALLELOPIPED. A parallelopiped whose lateral edges are perpendicular to the bases. RECTANGULAR PARALLELOPIPED. A right parallelopiped whose bases are rectangles.

PARENTHESIS. A symbol of grouping; used to group together terms which are to be treated as a single expression. The symbol for parenthesis is ( ).

PART. A portion or divison of the whole.

PASCAL (1623 - 1662) He was a contemporary mathematician whose genius perhaps equalled that of the great Fermat. At nineteen he invented his famous machine for performing arithmetical operations mechanically.

PENCIL OF LINES. Any number of lines which can be passed through a point. The point is the VERTEX of the pencil of lines.

PENCIL OF PLANES. The totality of planes through any straight line, l. L is called the axis of the planes.

PENTADECAGON. A fifteen sided polygon.

PENTAGON. A polygon of five sides.

PENTAGRAM. A five pointed star-shaped figure made by extending the sides of a regular pentagon until they meet.

PENTAHEDRON. A solid figure having five faces.

PENTANGLE. A pentagram; also, a pentagon.

PENTANGULAR. Having five angles.

PER CENT. By the hundred; used in expressing proportions, rates of interest, etc. Symbol, %.

PERCENTAGE. Rate of interest on a hundred.

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PERFECT SQUARE. An expression that may be separated into two equal factors.

PERIGON. An angle equal to two straight angles, or 360°. Also, ROUND ANGLE.

PERIMETER. The circumference, or outer boundary of a superficial figure. PERIMETER OF TRIANGLE. See Triangle.

PERIODIC FRACTION. See Fraction.

PERIODIC FUNCTION. See Function.

PERMANENCE. A permanence of sign is said to occur when two successive terms of a series have "like" signs.

PERMUTATIONS. Of any number of things are the different orders in which they can be arranged, taking a certain number at a time. CIRCULAR PERMUTATIONS. When different letters are arranged in a circle, any one of their permutations can without change be revolved so that any letter, as "a", shall have a given position.

PERPENDICULAR. Meeting at right angles. PERPENDICULAR BISECTOR. See Bisector.

PERPETUAL ANNUITY. See Annuity.

PERSPECTIVE. The appearance of objects with reference to relative position, distance.

PHYSICAL. Pertaining to material nature. PHYSICAL SOLIDS. See Solids.

PI. The letter π, used as a symbol for the ratio (3.141592+) of the circumference of a circle to its diameter; also, the ratio itself.

PINS. CHAINING PINS. See Chaining.

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PLACED. Put in a particular position, situation, or relation. SIMILARLY PLACED. Similar figures are said to be similarly placed when so placed that each side of the one shall be parallel to the homologous side of the other.

PLANE. A surface such that a straight line joining any two of its points lies wholly within that surface. Beigg wholly within a plane, as geometrical figures of two dimensions (length and breadth). (Plane angle, plane, figure, plane geometry, plane surface); see nouns. PLANE TABLE. An intrument using the principle of scale drawing to locate points in making maps, and to find distances. (Plane tangent, plane trigonometry); see nouns.

PLANIMETER, POLAR. This is an instrument for measuring areas mechanically.

PLATO, (429 - 348 B. C.) He was a pupil and near friend of Socrates. After traveling in Egypt, Lower Italy, and Sicily, he returned to Athens, about 389 B. C., and founded his school in the groves of the Academia, and devoted the remainder of his life to teaching and writing. His writings were filled with mathmatical discoveries, and exhibited on every occasion the remarkable connection between mathematics and philosophy. One of his greatest achievemnts is the invention of Analysis as a method of proof. He did little original work, but he made valuable improvements in the logic and methods employed in geometry.

PLOTTING POINTS. Locating points as in a graph.

POINT. Something that has position but not extension. DIST-

ANCE OF A POINT. The line drawn from the origin to the point; this distance is independent of sign. MINIMUM POINT OF A GRAPH. The point of a graph that has the algebraically least ordinate. PROJECTION OF A POINT. The foot of the perpendicular drawn from a given point to a given plane is the projection of the point on the plane. GEOMETRIC POINT. The extremity of a line. The intersection of two lines or of three planes. That which has position only. POINT OF SYMMETRY. See Symmetry. POINT OF TANGENCY. See Tangent.

POINTS, CARDINAL POINT. See Cardinal. CORRESPONDING POINTS. The points where a line perpendicular to the major axis meets the ellipse and its auxiliary circle. Three or more points that lie onthe same line are COLLINEAR POINTS. The four points, A, B and P, Q, of which each pair divide harmonically the line terminated by the other pair, are called FOUR HARMONIC POINTS. See also Harmonically. Two points so situated that an indefinite line is the perpendicular bisector of the line joining them are said to be OPPOSITE POINTS with respect to that indefinite line.

POLAR. Pertaining to a pole. POLAR DISTANCE. See Distance. POLAR DISTANCE OF A CIRCLE. See Circle.

POLE. A measure of length or surface, a rod, or a square rod.

POLES. Each of the extremities of the axis of a spherical body. POLES OF A CIRCLE. The ends of the axis.

POLYGON. A plane figure bounded by any number of straight lines. The BASE of a polygon is the side on which it is supposed to stand. A CONCAVE POLYGON has at least one angle that is greater

than a straight angle. A polygon is CIRCUMSCRIBED about a circle when its sides are tangent to the circle. A DIAGONAL OF A POLYGON is a line-segment joining any two vertices which are not consecutive. An EQUIANGULAR POLYGON has all its angles equal. An EQUILATERAL POLYGON has all its sides equal. The EXTERIOR ANGLES of a polygon are formed by extending one side at each vertex. The FACES of a polygon are the sides. A POLYGON is INSCRIBED in a circle when its vertices are on the circle and its sides are chords. The PERIMETER OF A POLYGON is the sum of its sides. If the line-segments from a given point to the vertices of a given polygon are all divided in the same ratio and the points of division are connected in the same order as the vertices of the polygon, the polygon thus formed is said to be RADICALLY SITUATED with respect to the original polygon. THE RADIUS OF A REGULAR POLYGON is the radius of the circumscribed circle. A REGULAR POLYGON is both equilateral and EQUIANGULAR. SIMILAR POLYGONS are polygons that have their homologous sides proportional and their homologous angles equal. SPHERICAL POLYGONS. See Spherical.

POLYHEDRAL ANGLE. A figure formed by three or more rays that are not coplanar and that have their origin in a common point, together with the portions of planes determined by pairs of adjacent rays and included between them. The origin of the rays is the VERTEX of the polyhedral angle. The angles formed by the pairs of adjacent rays are the FACE ANGLES. A polyhedral angle is CONVEX if every one of its sections is a convex polygon. If a polyhedral angle is in-

tersected by a plane cutting all the edges, the polygon formed by the intersection of the plane and the faces is a SECTION OF THE POLYHEDRAL ANGLE.

POLYHEDRAL ANGLE. The figure formed by three or more rays that are not coplaner and that have their origin in a common point, together with the portions of planes determined by pairs of adjacent rays and included between them.

POLYHEDRAL ANGLES. Two POLYHEDRAL ANGLES are CONGRUENT if the equal parts of the other and are arranged in the same order. Two POLYHEDRAL ANGLES SYMMETRIC. The parts of one polyhedral angle are arranged in an order that is the reverse of the order of the parts of the other.

POLYHEDRON. A closed solid figure whose bounding surfaces are planes. The BASE of a polyhedron is the face on which it stands. A polyhedron all of whose faces are tangent to a given sphere is CIRCUMSCRIBED about the sphere. A polyhedron is CONVEX if every section of it is a convex polygon. A DIAGONAL of a polyhedron is a line-segment joining any two of its vertices not in the same face. The EDGES are the intersections of the faces. The bounding planes are the FACES of the polyhedron. A polyhedron all of whose vertices are on a sphere is INSCRIBED in the sphere. A REGULAR CONVEX POLYHEDRON A polyhedron whose faces are congruent regular polygons and whose polyhedral angles are all congruent. If a polyhedron is intersected by a plane, the polygon formed by the intersections of the plane and the faces is a SECTION of the polyhedron. The vertices are the intersections of the edges.

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POLYHEDRONS. TWO POLYHEDRONS are SIMILAR if they have the same number of faces, similar to each and similarly placed, and if their corresponding polyhedral angles are congruent.

POLYNOMIAL. An algebraic expression of two or more rational integral terms; an algebraic expression composed of parts connected by the signs + and - is a polynomial, also called a multinomial.

POSITIVE. Denoting a quantity greater than zero; involving or denoting addition, or plus, + sign is the symbol. POSITIVE FRACTIONAL EXPONENT. See EXPONENT. (Positive numbers, positive, quantity, positive term); see nouns.

POSTULATE. A construction assurred to be possible. PARALLEL POSTULATE. Only one line can be drawn through a given point parallel to a given line. Thus is the Euclidian parallel postulate.

POWER. The product obtained by multiplying a quantity by itself one or more times (as 4 is the second, 8 the third, 16 the fourth, POWER of 2.) INDEX OF A POWER. Same as exponent. When a number is used twice as a factor, the product is the SECOND POWER of the number. When a number is used three times as a factor, the product is the THIRD POWER of the number. When a number is used three times as a factor, the product is the THIRD POWER of the number.

POWERS. A polynomial is arranged in ASCENDING POWERS OF X when the term of the lowest degree in X is placed first, the term of next higher degree second, etc., and the term not containing X placed first. When arranged in opposite order from ascending powers of X the polynomial is arranged according to DESCENDING powers of X.

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PRIME. Of first order; fundamental. (Prime factors, prime number) See nouns. A mark, as a', a", etc. added to a letter to distinguish it from other.

PRINCIPAL. First in value, importance; of first order; a capital sum. FUNDAMENTAL PRINCIPAL OF PROBABILITY. If one thing can be done in "m" ways, and (after it has been done in any one of these ways) a second thing can be done in "n" ways; then the two things can be done in "m" X "n" ways. PRINCIPAL ROOT. See Root.

PRINCIPLES OF PROPORTION. See Proportion.

PRISM. A polyhedron having two faces that are congruent polygons, similarly situated in parallel planes, and the remaining faces parallelograms. The ALTITUDE of a prism is the perpendicular distance between its bases. The congruent faces are the BASES of the prism. A PRISM CIRCUMSCRIBED ABOUT A CYLINDER. See CYLINDER. A prism is INSCRIBED in a cylinder when the lateral edges of the prism are elements of the cylinder and the bases are inscribed in the bases of the cylinder. The cylinder is said to be CIRCUMSCRIBED about the prism. The LATERAL AREA of a prism is the sum of the areas of the lateral faces. The intersections of the lateral faces are the LATERAL EDGES. The remaining faces (not including the bases) are the lateral faces of the prism. A prism is an OBLIQUE PRISM if its lateral edges are oblique to the bases. A REGULAR PRISM IS a right prism whose bases are regular polygons. A prism is a RIGHT PRISM if its lateral edges are perpendicular to the bases. A RIGHT SECTION of a prism is a section made by a plane cutting all

the lateral edges and perpendicular to them. A TRUNCATED PRISM is that part of a prism included between a base and a section made by a plane oblique to the base which cuts all the lateral edges.

PRISMATIC SPACE. See Space.

PRISMATOID. A polyhedron which has for bases two polygons in parallel planes, and for lateral faces triangles or trapezoids with one side common with one base and the opposite vertex or side common with the other base. The ALTITUDE of a prismatoid is the perpendicular distance between the planes of its bases. The MID - SECTION of a prismatoid is the section made by a plane parallel to its bases and midway between them.

PROBABILITY, or chance. The likelihood of an event happening, as measured by the relative frequency of events of the kind in the course of experience. If a represents the favorable and b the unfavorable possiblities, then the sum of the two probabilities $\frac{a}{a+b}$ and $\frac{b}{a+b}$ is unity.

PROBLEM. A proposition requiring something to be done. DETERMINATE PROBLEM. A problem that has a definite number of solutions. GENERAL PROBLEM. A problem all of the numbers in which are general numbers. INDETERMINATE PROBLEM. A problem that has an indefinite number of solutions when for a particular value of the independent variable, a function takes on one of the forms $\frac{0}{0}$, $0 \cdot \infty$, $\infty - \infty$, 0°, $\frac{\infty}{\infty}$, etc. it is said to be indeterminate, and the function is not defined for that value of the independent variable by the given analytical expression.

PROBLEMS. An industrial and mechanical work it is often nec-

essary to find the amount of time needed to complete a certain piece of work, especially when several persons or machines are involved. Such problems are WORK PROBLEMS.

PRODUCED. Pertaining to a segment drawn out to a greater length.

PRODUCT. The result obtained by multiplying together two or more numbers. The PRODUCT of two line-segments such as A and B, written AB, is the product of their numerical measures.

PROGRESSION. A succession of quantities in which there is a constant relation between each member and the one preceeding it. ARITHMETICAL PROGRESSION. The members increase or decrease by a common difference. The common difference may be positive or negative. GEOMETRICAL PROGRESSION. Each member is derived from the preceeding one by multiplication by a constant factor. The constant factor is called the common ratio of the progression.

PROJECTION. The act, process, or result of projecting; the projecting of a figure, etc., upon a surface, or the representation or picture formed. CENTRAL PROJECTION. When any object is projected from the eye, and a plane is intercepted between the eye and the object, there will be for each ray of light from the object to the eye a point projected on this plane, the figure in the plane resulting from the aggregate of points is a projection of the object and the process of obtaining this figure is called central projection. Parallel and orthographic projection are special cases of central projection. When the eye is considered to be at an infinite distance from the object.

The orthogonal projection of a line-segment upon a given line is the part of the line between the feet of the perpendiculars drawn from the extremities of the line-segment to the given line. The line-segment may touch or intersect the given line, or may lie entirely outside it.

PROOF. A course of reasoning by which the truth or falsity of any statement is logically established. The method of proof that asserts that a proposition under consideration is true if another proposition is true, and so on, step by step, until a known truth is reached, is the ANALYTIC METHOD. The INDIRECT METHOD OF PROOF or REDUCTIO AD ABSURDUM assumes the proportion false then shows that this assumption is absurd. BY SUPERPOSITION. See Super-Position. SYNTHETIC METHOD of proof is putting together some known truths in order to obtain a new truth.

PROPER FRACTION. See Fraction.

PROPORTION. The equality of two ratios. In the proportion $\frac{a}{b} = \frac{b}{c}$, b is the mean proportional between a and c. In this case the three terms are in CONTINUED PROPORTION. The PRINCIPLES OF A PROPORTION are the fundamental laws of proportion. The FOUR TERMS of a proportion are the four numbers. See extremes and means.

PROPORTIONAL. Having the same or a constant ratio or relation. One of the quantities of a proportion. The last term of a proportion is the FOURTH PROPORTIONAL to the other three, provided the second and third terms are unlike. If in a proportion, the two means are equal, this common mean is the MEAN PROPORTIONAL, or GEOMETRIC MEAN, between the two extremes. When three terms are in continued proportion, the last term is the THIRD PROPORTIONAL to the other two terms.

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PROPOSITION. Either a theorem or a problem. A GEOMETRIC PROPOSITION is a statement concerning certain properties of geometric figures. PYTHAGOREAN PROPOSITION. The sum of the squares on the sides of a right triangle is equal to the square on the hypotenuse.

PROTRACTOR. An instrument for laying down and measuring angles on paper.

PURE QUADRATIC. See Quadratic.

PURE IMAGINARY EQUATION. See Equation.

PURE IMAGINARY NUMBER. See Number.

PYRAMID. A polyhedron bounded by a polygon and a number of triangles that have a common vertex. The ALTITUDE OF A PYRAMID is the perpendicular distance from the vertex to the plane of the base. The BASE of a pyramid is the polygon. A pyramid is CIRCUMSCRIBED about a cone when the lateral faces are tangent to the cone and the base of the pyramid is circumscribed about the base of the cone. A truncated pyramid is a FRUSTUM of a pyramid if the intersecting plane is parallel to the base. HEIGHT OF PYRAMID. Same as altitude. A pyramid is INSCRIBED in a cone when the lateral edges of the pyramid are elements of the cone and the base of the pyramid is inscribed in the base of the cone. The LATERAL FACES of a pyramid are the triangles. A pyramid is QUADRANGULAR if its base is a quadrilateral. A REGULAR PYRAMID has a regular polygon for its base and the perpendicular from the vertex to the base meets the base at the center of the polygon. The SLANT HEIGHT of a regular pyramid is the altitude of one of the face triangles. The SLANT HEIGHT of the frustum of a regular pyramid is the altitude of one of the lateral faces. SPHERICAL PYRAMID.

See Spherical. TRIANGULAR PYRAMID A tetrahedron. A TRUNCATED PYRAMID is the part of a pyramid included between the base and a plane cutting all the lateral edges. The common vertex of the lateral faces of the pyramid is the vertex of the pyramid.

PYRAMIDAL SURFACES. See Surfaces.

PYTHAGORAS (580? - 800? B. C.) He was the greatest pupil of Thales and probably born on the island of Samos near Asia Minor. He was one of the most remarkable men of antiquity and gave to us many of the proofs of theorems given in our geometries of today. He is said to have been the first one to prove that the square on the hypotenuse of a right angle is equal to the sum of the squares on the other two sides.

PYTHAGORIAN PROPOSITION, See Proposition.

PYTHAGOREAN THEOREM, The square of the hypotenuse of a right triangle is = to the sum of the squares of the legs. This theorem is called the Pythagorean Theorem, deriving its name from Pythagoras, the Greek mathematician who formulated it. Many proofs of this theorem have been presented. The first proof of the theorem is attributed to Pythagoras about 525 B. C., but his method of demonstration is unknown. Euclids proof is purely geometric while that of the Hindu Mathematicians is algebraic in character.

QUADRANGULAR PYRAMID. See Pyramid.

QUADRANT, One quarter of a circumference or area of a circle.

QUADRATIVE OF A CIRCLE. See Circle.

QUADRATIC. Square, involving the square and no higher power of the unknown quantity. A quadratic equation that contains both the second and the first powers of one unknown number is an AFFECTED

QUADRATIC. BINOMIAL QUADRATIC. A binomial of the second order. COMPLETE QUADRATIC. A quadratic equation which contains both the second power and the first power of the unknown and a constant term; if it contains only the second power or the second power and one of the other terms it is called an INCOMPLETE QUADRATIC. (Quadratic Figure, Quadratic Function) See Nouns. PURE QUADRATIC an equation that contains only the second power of the unknown number. (Quadratic Equation, Quadratic equation in two variables) See Equation. QUADRATIC SURD. See Surd.

QUADRATRIX. A curve invented by Hippias (? 425 B. C.) in his attempt to divide an angle into any number of equal parts.

QUADRILATERAL. A polygon of four sides.

QUALITY. Character or nature. Signs of quality. The signs + and - when used to denote positive and negative numbers.

QUALITIES. The + and - signs denote OPPOSING QUALITIES of numbers and are used to distinguish between OPPOSITE QUANTITIES.

QUANTITY. Anything that can be increased, diminished, or measured; as any portion of time or space, any distance, force or weight. QUANTITY is often used to denote number. NEGATIVE QUANTITY one that is preceeded by a minus (-) sign. OPPOSITE QUANTITIES are distinguished by the plus (+) and minus (-) signs. POSITIVE QUANTITY one that is preceeded by a plus (+) sign. VARIABLE QUANTITY, a changing number. RATIO OF TWO CONCRETE QUANTITIES has meaning only if they are of the same unit. This ratio is the quotient of their measures in terms of the same unit of measures.

Q. E. D. stands for "quod erant demonstrandum", which was to be provēd.

Q. E. F. stands for "quod erat faciendum", which was to be done.

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RADICAL. An indicated root of any algebraic or arithmetic expression, as, $\sqrt{a}$, $\sqrt[3]{5}$, $\sqrt{ab}$. CONJUGATE RADICALS are radical expressions of the form $a+\sqrt{b}$ and $a-\sqrt{b}$; $\sqrt{x}+\sqrt{y}$ and $\sqrt{x}-\sqrt{y}$. RADICAL EQUATION an indicated root of any equation. SIMILAR RADICALS. Radicals that in their simplest form are of the same order and have the same radicand.

RADICAND. The number whose indicated root is to be found. It is the expression under the radical sign.

RADIUS. The line segment which joins the center to any point on the circle. FOCAL RADIUS. A line joining the focus to any point on a curve. (Radius of a circle, radius of a regular polygon, radius of a sphere); see Nouns.

RADIUS OF CURVATURE OF A CURVE OF A POINT. The reciprocal of the curvature of the curve at that point.

RADIAN. The angle, which, when the vertex is placed at the center of a circle, intercepts an arc equal to the radius of the circle. One radian $\left(\frac{180}{\pi}\right)$ = 57.3° approx.

RATE. A number of units of length in the unit of time. The RATE of uniform motion is the number of units of space traversed in each unit of time, is the SPEED or RATE And is represented by R.

RATIO, of one number to another, the quotient of the first number divided by the second. A line is said to be divided in Extreme and MEAN RATIO by a point when one of the segments is the mean proportional between the whole line and the other segment. INCOMMENSURABLE RATIO. The ratio of two incommensurable quantities; and is a fixed value which its successive approximate values constantly approach. INVERSE RATIO is one (1) divided by the number. (Ratio of concrete quantities,

ratio of greater inequality, ratio of inequality, ratio of similtude) see nouns. Reciprocal Ratio, is one (1) divided by the number. TRIGONOMETRIC RATIOS are the sine, cosine, tangent, cotangent, secant, and coesecant. These ratios are defined in terms of the sides of a right triangle and are used in indirect measurement of heights and distances. VALUE OF A RATIO, the quotient expressed in its lowest terms.

RATIONAL, Expressible in finite terms; involving no root which cannot be extracted. Opposed to imperical.

RATIONAL INTEGRAL FUNCTION. See Function.

RATIONAL NUMBER. See Number.

RATIONALIZAING. The process of multiplying an expression containing a surd by any expression that will make the product rational.

RATIONALIZING THE DENOMINATOR. See Denominator.

RATIONALIZING A FACTOR. See Factor.

RATIONALIZING A SURD. See Surd.

REAL NUMBER. See Number.

RECIPROCAL. The RECIPROCAL of a number is unity (1) divided by that number.

RECIPROCAL EQUATION. See Equation. RECIPROCAL RATIO. See Ratio.

RECTANGULAR. See Coordinate.

RECTANGULAR COORDINATE. See Coordinate.

RECTANGULAR GRAPH. See Graph.

RECURRING EQUATION. See Equation.

"REDUCTIO AD ABSURDUM". Sometimes called an indrect proof. A process of reasoning where in a statement is assumed to be false and then it is

shown that the assumption is absurd.

REDUCTION. The process of changing the form of an expression without changing its value. REDUCTION OF FRACTION. See Fraction. REDUCTION OF A SURD. See Surd.

RE-ENTRANT ANGLE. See Angle.

REMAINDER. The number which added to the subtrahend gives the minuend. That which is left after subtraction or division.

REMAINDER THEOREM. See Theorem.

RECTANGLE. A parallelogram all of whose angles are right angles. RECTANGULAR PARALLELEPIPED. See Parallelpiped.

RECURRING EQUATION. An equation that repeats itself after a series of operations.

RECURRING FRACTION. See Fraction.

RECTALINEAL FIGURE. See Figure.

REFLEX ANGLE. See Angle.

REGULAR Governed by one law throughout (as a REGULAR polygon, one having all its angles equal and all its sides equal) (Regular octagon, regular polygon, regular polyhedron, regular prisms regular tetrahedron) See nouns.

RELATION. The state of being connected, or a particular connection. PYTHAGOREAN RELATION. See Pythagorean. SIGNS OF RELATION. Sign of equality (=), sign of idenity ($\equiv$), sign of inequality ($>$ or $<$) the opening being toward the greater quantity.

REPRESENTATION Expression or designation by some term, character, symbol, in the like. GRAPHICAL REPRESENTATION. See Graphical.

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RESULT. A quantity, value, etc., obtained by calculaction. CHECKING THE RESULT. See CHecking.

REVOLUTION. The angle formed when a line turns around one of its extremities until it comes to its original position. Also a COMPLETE REVOLUTION. CYLINDER OF REVOLUTION. A right circular cylinder is such because it may be generated by the revolution of a rectangle about one side as an axis. SIMILAR CONES OF REVOLUTION. The cones generated, if two similar right triangles are revolved about corresponding sides as axes. SIMILAR CYLINDERS OF REVOLUTION. The cylinders generated, if two similar rectangles are revolved about corresponding sides as axes.

RHOMBOID. A parallelogram with all its angles oblique.

RHOMBUS. A quadrilateral all of whose sides are equal.

RHETORIC STAGE. See Stage.

RIEMANN(1826 - 1866 A. D.) He was an extraordinarily gifted but shy genius. He laid the foundation for a general theory of functions of a complex variable. He developed a new non-Euclidian geometry, carrying his ideas of space to n dimensions.

RIGHT ANGLE. See Angle.

RIGHT CIRCULAR CONE. See Cone.

RIGHT CIRCULAR CYLINDER. See Cylinder.

RIGHT CYLINDER. See Cylinder.

RIGHT NUMBER. See Number.

RIGHT PARALLELOPIPED. See Parallelopiped.

RIGHT PRISM. See Prism

RIGHT SECTION. See Section.

RIGHT SIDES OF AN EQUATION. See Equation.

RIGHT SECTION OF ANGLE. See Angle.

RIGHT TRIANGLE. A triangle one of whose angles is a right angle. LEGS OF RIGHT TRIANGLE. The two sides adjacent to the right angle.

ROOT OF AN EQUATION. Any value of the unknown number that satisfies the equation; Root of a number one of its equal parts. That number whose nth power is a given number is said to be the nth root of the given number. CUBE ROOT, one of the three equal factors whose product is the number. (Also THIRD ROOT). EVEN ROOT, a root whose index is an even number. INDEX root sign ($\sqrt{}$) to denote what root is intended. EXTRANEOUS ROOTS. See Extraneous. PRINCIPAL ROOT, the real root which has the same sign as the number itself. SQUARE ROOT (Second root), one of the two equal factors whose product is the number. SET OF ROOTS. A set of values for the unknowns satisfying an equation in two or more unknowns or a system of such equations.

RULE. A determinate method prescribed for performing an operation. The method of finding the fourth term in a proportion when three terms are given. (Rule of Hypotenuse. Rule of Computation, Rule of Multiplication,) See Nouns.

SALIENT ANGLE. See Angle.

SAME AFFECTION Of two angles, if both are greater or both are less than 90°. They are of OPPOSITE AFFECTION if one is greater and the other less than 90°.

SATISFY To fulfill the requirements or conditions. To SATISFY AN EQUATION both sides of the equation reduced to the same number for certain values of the unknown numbers.

SCALE. A mathematical instrument consisting of a slip of wood, ivory, or metal, with one or more sets of spaces graduated and numbered on its surface, for measuring or laying off distances, dimensions, etc. A series of spaces marked by lines, representing proportional larger distances; as a scale of miles for a map. A basis for the numerical system, as, the decimal scale. ARITHMETIC SCALE. The numbers are equally spaced. DIAGONAL SCALE. An instrument whose construction is based upon principles of proportional line segments. LOGARITHMIC SCALE. A table of logarithms marked off to scale along the edges of a rule. NUMBER SCALE. An arrangement of numbers represented geometrically on a straight line with reference to a point O in that line; from left to right along the number scale the numbers are increasing; from right to left along the numbers scale the numbers are decreasing. SCALE DRAWING. A system of proportion by which definite magnitudes represent definite magnitudes. An application of the principle of similarity. SCALE OF RELATIONS See Relations.

SCALENE Uneven, unequal. SCALINE TRIANGLE See Triangle.

SCHOLIUM. A remark upon some particular feature of a proposition. Scho. = symbol for scholium.

SECANT. A straight line of indefinite length that cuts a circle in two distinct points, or it is an extended chord of the circle. In Trigonometry it is the ratio of the hypotenuse to the adjacent leg. of a right angle. The part of a secant which lies between an external point and the second point, of intersection with the circle is the LENGTH OF THE SECANT from the EXTERNAL POINT.

SECOND' Next after the first in order, place, etc. The sixtieth part of a minute of time or angle. The sign is ". SECOND POWER. See Power. SECOND ROOT. See Root.

SECTION. The intersection of a plane and a surface. A part cut off or separated, or so conceived of; divison, portion; slice. CONIC SECTION. See Conic. GOLDEN SECTION. The division of a line in extreme and mean ratios which occurs in Euclid in two propositions with different method of construction. (Section of a Cylinder, Section of Polyhedral Angle, Section of a Polyhedron, Section of a Sphere, A Right Section of a Prims is a section made by a plane perpendicular to the lateral edges of the prism. Right Section of a Cylinder) See Nouns.

SECTOR. An area bounded by two radii of a circle and the arc between them. ANGLE OF THE SECTOR. The angle between the two radii. SECTOR OF A CIRCLE. See Circle. SPHERICAL SECTOR. See Spherical.

SEGMENT. A part cut off from a figure by a line or a plane, as a part of a circular area contained by an arc and its chord. The MID-POINT of a LINE-SEGMENT is the point which divides the segment into two equal segments. A SEGMENT OF A CIRCLE is the figure formed

by a chord and its subtended arc. SEGMENT OF LINE. See Line. SPHERICAL SEGMENT. A portion of a sphere contained between two parallel planes. If one of the parallel planes is tangent to the sphere, the segment is a segment of one base.

SEGMENTS, EQUAL SEGMENTS. The extremities of the two segments coincide when placed one on the other. RATIO OF TWO LINE-SEGMENTS. See Line Segment.

SEMICIRCLE. An arc of half a circle.

SEMICIRCUFERENCE. Half a circumference.

SERIES. A succession of quantities of terms related in some definite way to one another or to another quantity or quantities. DIVERGENT INFINITE SERIES. The sum of the first n terms of an infinite series does not approach a definite limit when $n = \infty$, and has no finite sum. FINITE SERIES. A series having a limited number of terms. INFINITE SERIES. A series having an unlimited number of terms. INFINITE CONVERGENT SERIES. An infinite series having the sum of the first n terms approach a limit, as n is increased indefinitely. The limit is said to be the SUM of the infinite series. INFINITE GEOMETRIC SERIES. A geometric series in which the number of terms, such as $a + ar + ar^2 + \ldots$, is unlimited. RECURRING SERIES. A series in which each term after the nth term bears a uniform relation to the n preceeding terms. If n = 1, the series is of the FIRST ORDER, if n= 2, it is of the second order, and so on.

SET OF ROOTS. See Roots.

SEXTANT. The sixth part of a circle; an instrument used in measuring angular distnaces.

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SHANKS (1812 - 1882) He worked out the value of π correct to 707 decimal places.

SIDE. One of the surfaces or lines bounding a figure. INITIAL SIDE. The side pertaining to the front, or first side. TERMINAL SIDE. The side pertaining to the end.

SIDES. The SIDES of an angle are the two lines which form it. HOMOLOGOUS SIDES. The corresponding sides of similar triangles. The sides of an angle when viewed from the vertex are RIGHT and LEFT SIDES, respectively.

SIDES OF TRIANGLE. See Triangle.

SIGN. A conventional mark, figure, or symbol used technically instead of the word or words which it presents. (Sign of direction, sign of a fraction, sign of operation, sign of opposition, sign of quality, sign of variation); see nouns.

SIGNS. Plural of sign. (Signs of abbreviation, signs of operation, signs of relation, signed numbers); see nouns.

SIMILAR. Alike in shape, irrespective of size. SIMILAR CONES OF REVOLUTION. See revolution. SIMILAR CYLINDER. See Cylinder. SIMILAR CYLINDER OF REVOLUTION. See Revolution. (Similar figures, similar fractions, similar polyhedrons, similar radicals, similar surds, similar terms, similar triangles); see nouns.

SIMILARLY PLACED. See Placed.

SIMILITUDE. Likeness, or similarity. If the lines joining corresponding vertices of two similar polygons are concurrent the point in which these lines meet is called the CENTER OF SIMILITUDE.

RATIO OF SIMILITUDE OF TWO POLYGONS. The ratio of any two homologous lines in similar polygons.

SIMPLE EQUATION. See Equation.

SIMPLEST FORM OF A RADICAL. See Radical.

SIMULTANEOUS. Existing, occuring, or operating at the samt time. SIMULTANEOUS EQUATIONS. See Equations. SIMULATANEOUS SYSTEM. See System.

SINE. The ratio of the opposite side over the hypthenuse of a triangle. The constant ratio of the side opposite an acute angle of a right triangle and the hypotenuse. A perpendicular line drawn from one extremity of an arc of a circle to the diameter which passes through its other extremity. COVERSED SINE. One minus the sine. LAW OF SINES. The equations given, the relationship of the sides of a triangle to the angle opposite those sides, e. i. $\frac{a}{\sin A} = \frac{b}{\sin B} \cdot \frac{c}{\sin C}$. VERSED SINE. One minus the cosine

SINGULAR POINT. Certain points at which a plane curve has peculiarities are called singular points. The cusp is an example.

SIZE. The dimensions, proportions, or magnitude (linear, square, solid, numerical, etc.) of anything. SIZE OF ANGLE. See Angle.

SKEW. Having an oblique direction or position. SKEW LINE. See Line.

SLANT HEIGHT. Slanting; oblique height. SLANT HEIGHT OF CONE. See Cone. SLANT HEIGHT OF FRUSTUM OF CONE. See Frustum. SLANT HEIGHT OF FRUSTUM OF PYRAMID. See Frustum. SLANT HEIGHT OF PYRAMID. See Pyramid.

SLOPE. See Derivative.

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SMALL. Of limited size. SMALL CIRCLE. See Circle. SMALL CIRCLE OF SPHERE. See Sphere.

SMOOTH LINE GRAPH. See Graph.

SOLID. A portion of space completely enclosed by a surface or a combination of surfaces; that which has length, bfeadth, and thickness. The ALTITUDE OF A SOLID is the perpendicular dropped from its highest point upon the plane of the base. The BASE OF A SOLID is that one of its faces which we select for distinction. GEOMETRIC SOLID. A limited portion of space, such as that bounded by a sphere, or a cube, etc. PHYSICAL SOLID. The substance of a space. SOLID GEOMETRY. See Geometry.

SOLIDS. CONGRUENT SOLIDS. Two solids that coincide. EQUIVALENT SOLIDS Two solids that have the same volume.

SOLUTION. The result of certain mathematical processes. ALGEBRAIC SOLUTION. The solution of the problem is accomplished by the use of the equation. A pair of values of X and Y satisfying both equations is a COMMON SOLUTION of THE TWO EQUATIONS. THE GRAPHICAL SOLUTION of two linear equations consists in plotting the two equations and finding from the graph the value of X and the value of Y at the point of intersection. The SOLUTION of a problem is the result of the processes suggested or required by the problem.

SOLUTION OF THE EQUATION. See Equation.

SOLVING AN EQUATION. See Equation.

SPACE. An interval of time. A limited portion of distance, area or volume. An expanse extending in all directions indefinitely. GEOMETRY

OF SPACE. See Geometry. By the definition of prismatic surface, when its faces are taken in certain assignable order, each face, beginning with the first face, m, intersects its succeeding face; if also the last face, mn, intersects the first face, then the prismatic surface is said to enclose a PRISMATIC SPACE.

SPECIFIC GRAVITY. The ratio of the weight of a given volume of any substance to that of the same volume of some other substance taken as a standard, water being the standard for solids and liquids, and hydrogen or air for gases; relative density. See Gravity.

SPHERE. A closed solid figure bounded by a curved surface every point of which is equidistant from a point within called the CENTER. The intersection of a sphere made by a plane is a CIRCLE OF A SPHERE. THE DIAMETER OF A SPHERE is a line-segment through the center terminating in the surface. GREAT CIRCLE OF A SPHERE. A circle of a sphere whose plane contains the center of the sphere. The RADIUS of a sphere is a line-segment from the center to any point on its surface. SMALL CIRCLE OF SPHERE. A circle of the sphere whose plane does not contain the center. A SECTION OF A SPHERE is made by a plane is a circle.

SPHERICAL. Pertaining to a sphere. SPHERICAL ANGLE. The angle formed by two intersecting arcs of great circles on a sphere. The arcs are the SIDES of the angle, and the point of intersection is the VERTEX. A spherical angle is ACUTE, OBTUSE, RIGHT, etc., according as the angle between the tangents is acute, obtuse, right, etc.

SPHERICAL DEGREE. See Degree.

SPHERICAL DISTANCE. See Distance.

SPHERICAL EXCESS. The number of degrees of a spherical triangle by which the sum of the angles exceeds two right angles. The number of degrees of a spherical polygon by which the sum of the angles exceeds (n-2) straight angles.

SPHERICAL POLYGON. A closed figure on a sphere bounded by arcs of great circles. The SPHERICAL ANGLES are the angles of the polygon. A spherical polygon is CONVEX if its polyhedral angle at the center is convex. DIAGONAL OF A SPHERICAL POLYGON The arc of the great circle connecting any two non-consecutive vertices. The SIDES of a spherical polygon are the arcs; their points of intersection, the vertices.

SPHERICAL PYRAMID. A solid having a spherical polygon for a base and for lateral faces the faces of the polyhedral angle formed by connecting the vertices of the base with the center of the sphere.

SPHERICAL SECTOR. That portion of a sphere generated by the revolution of a circular sector about any diameter of its circle as an axis.

SPHERICAL SEGMENT. See Segment.

SPHERICAL SURFACE, A surface which is everywhere equally distant from the center.

SPHERICAL TRIANGLE See Triangle.

SPHERICAL WEDGE. See Wedge.

SQUARE. An equilateral rectangle. The second power of a number or quantity. The AREA of a SQUARE equals the length times the width. SQUARE OF A MONOMIAL. See Monomial. Square of a number. See number. PERFECT SQUARE. An expression that may be separated

into two equal factors. TRINOMIAL SQUARE. A trinomial which is the square of a binomial.

SQUARES. THE DIFFERENCES OF THE SQUARES OF TWO NUMBERS. The product when the sum of two numbers is multiplied by the difference of the same two numbers.

SQUARE INCH. ONE SQUARE INCH. A square, each side of which is one inch in length.

SQUARE ROOT. See Root.

STAGE. A step or a degree in a process. RHETORICAL STAGE. A stage in which all solutions are wirtten out in full, much as in arithmetical analysis. THE SYMBOLIC STAGE. A stage in which symbols are used to denote numbers, operations, and relations.

STRAIGHT. Stretched or extended; a line generated by a point moving constantly in the same direction. STRAIGHT ANGLE. An angle whose sides extended in exactly opposite directions from the vertex, forming a straight line; an angle of 180 degrees. STRAIGHT LINE. See Line.

SUBNORMAL. The length of the projection of the normal on the axis of x, from the point where the normal cuts the curve to the point where it cuts the axis) x, is called the length of the subnormal.

STURM'S THEOREM. See Theorem.

SUBTANGENT. The length of the projection of the tangent on the axis of x, from the point of tangency to the curve to its intersection with the axis of x is called the length of the subtangent.

SUBTEND. To extend under, or be opposite to as, the hypotenuse

of a right triangle subtends the right angle; a chord subtends the arc whose extremities it joins. The arc is subtended by the chord.

SUBSCRIPTS. Something written below a number or letter for purposes of identification and having no numerical significance, as X_0, $4X_3$, t^2_m, t_w are read X sub zero, 4 X sub three, the square of t sub m respectively, etc.

SUBSTITUTE. To put (one number, or letter) in place of another when a number is put in place of a literal number, it is said to be SUBSTITUTED for the literal number.

SUBSTITUTION. The placing of one expression into another expreesion.

CYLIC SUBSTITUTION. The process of obtaining one formula from another by systamatic substitution.

SUBSTITUTION METHOD. The value of one unknown is found in terms of the other from one of the given equations, and by substituting this value for that unknown in the other equation.

SUBTRACT. To take (one number or quantity) from another; deduct.

SUBTRACTION. The process of taking one number or equation from another. ALGEBRAIC SUBTRACTION. The operation of finding the other part, having given an algebraic sum and one of its parts.

SUBTRAHEND. The number or quantity to be taken from another (the minuend) in the operation of subtraction.

SUM. The result obtained by adding two or more numbers. The ALGEBRAIC SUM OF TWO OR MORE NUMBERS. The number or result obtained by adding them according to the rules regarding positive and negative numbers. The SUM of TWO ANGLES. The total angle formed by placing two angles adjacent to each other.

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SUMMATION OF A SERIES. The process of finding an expression for the sum of all its terms.

SUPERPOSITION. The process of placing one geometric figure upon another to show whether they are equal or unequal. In THEORETICAL SUPERPOSITION the process is imagined to be done.

SUPPLEMENT. The quantity by which an angle or an arc falls short of 180° or a semicircle.

SUPPLEMENTARY ANGLES. Two angles whose sum is equal to a straight angle. Each of the angles is the supplement of the other.

SURD. An indicated root of a positive number which cannot be exactly obtained. ALGEBRAIC SURD. A surd whose radicand is an algebraic expression. ARITHMETIC SURD. A surd whose radicand is an arithmetical number. BINOMIAL SURD. A binomial, one or both of whose terms are surds. BINOMIAL QUADRATIC SURD. A binomial surd whose surd term or terms are of the second order. ENTIRE SURD or PURE SURD. A surd that has no rational coefficient except unity. MIXED SURD. A surd having a coefficient expressed. QUADRATIC SURD. A surd of the second order. RATIONALIZING A SURD. The process of multiplying the surd by a number that gives a rational product. REDUCTION OF A SURD. The changing of its form without changing its value. SURD EXPRESSION. See Expression.

SURDS. CONJUGATE SURDS. Two binomial quadratic surds that differ only in sign of one of the terms. LIKE SURDS have, or can be so reduced as to have, the same irrational factor; otherwise they are UNLIKE SURDS. SIMILAR SURDS., are surds which in their simplest form are of the same degree and have the same radicand, as $3\sqrt{2}$ and $-7\sqrt{2}$.

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SURFACE. An extension having only two dimensions; the boundary between two solid spaces not adjacent to a third space; the boundary of a solid. The AREA or NUMERICAL MEASURE of a SURFACE is the number of times that it contains the unit of measure. CONIC SURFACE. See Conic. CURVED SURFACE. A surface no part of which is a plane. CONVEX CONIC SURFACE. See Conic. CYLINDRICAL SURFACE. See Cylindrical. GEOMETRIC SURFACE. The boundary common to two adjacent portions of space. LATERAL SURFACE. See Lateral. PLANE SURFACE. See Plane. A surface which is determined by any three of its points not in a straight line. PYRAMIDAL SURFACE. A surface generated by a line passing through a fixed point, and moves so that it always touches a convex polygon whose plane does not contain the fixed point. SPHERICAL SURFACE. See Spherical. UNIT OF SURFACE. Any definite portion of a surface.

SURFACES. EQUIVALENT SURFACES. Two surfaces which have the same area.

SURVEYOR'S CHAINS. An instrument commonly used by surveyors for measuring distances. It is made up of a succession of links having loops at the ends, which are connected by rings.

SYMBOL. A sign, letter, figure, or other character or mark, or combination of letters or the like, used to represent something.

SYMBOLS. The following are some of the symbols that are commonly used in mathematics: + plus; - minus, or X multiplied by; ÷ or / divided by; ∴ therefore; ∵ since or because; = equals or is equivalent to; ≡ is identical with; ≅ is congruent to; > is greater than; < is less than; ∽ is similar; ∠ angle; rt. ∠ , right angle; ∠s angles; △ triangle; △s triangles; ▱ parallelogram; ⊥ perpendicular;

⊥s perpendiculars; // parallel; //s parallels; ⊙ circle; ⊙s circles; $\overset{\frown}{AB}$ arc AB ; → approaches as a limit; ≠ is not equal to; ≮ is not less than; ≯ is not greater than; "inches or seconds; 'feet or minuets; § section; ( ) paraenthesis; [ ] brackets; { } braces; ▭ rectangle; ⇌ approaches; : sign of ratio 'is to; ‾ vinculum; | vertical bar; 'and so on' = sign of continuation. SYMBOLS OF GROUPING. See Grouping.

SYMMETRIC. Exhibiting symmetry or harmonious relation in the size, form, and arrangement of parts on opposite sides of a plane, line, or point, as a whole, or its form of arrangement, or its parts as corresponding one with another. SYMMETRICAL FUNCTION. A function of a certain set of letters is said to be symmetric with respect to these letters when every interchange of two of the letters will transform the function into an identically equal function. (Symmetric angles, symmetric equations, symmetric figures symmetric polygons); see nouns. Two points are SYMMETRIC with respect to a GIVEN LINE if the line bisects at right angles the line-segment joining the points. The line is the AXIS OF SYMMETRY.

SYMMETRY. The correspondence, in size, form, and arrangement, of parts on opposite sides of a plane, line, or point, each part on one side having its conterpart (in reverse order) on the other side. AXIS OF SYMMETRY. See SYMMETRIC. CENTER OF SYMMETRY. The given point with which a figure is symmetric. LINE OF SYMMETRY. Axis of symmetry (See symmetric).

SYMPOLAR POLYGON. See Polygon.

SYNTHETIC DIVISION. See Division.

SYSTEM. An organized or complex whole. SYSTEM OF LOGARITHMS. See Logarithms. METRIC SYSTEM. See Metric. SIMULTANEOUS SYSTEM. A system in which all the equations can be satisfied by the same values of the variables.

SYSTEM OF EQUATIONS. See Equations.

SYMBOLIC STAGE. See Stage.

SYMBOL OF INDETERMINATION. See Indetermination.

TANGENT. To a circle a line which has only one point in common with the cirlce or a secant that meets it in two coincident points. The tangent of an acute angle of a right tirangle is the ratio of the opposite and adjacent sides. The constant ratio is the tangent of the angle. A tangent to two circles is called a COMMON EXTERNAL TANGENT if it does not cut the line of centers, and a COMMON INTERNAL TANGENT is it cuts the line of centers. LAW OF TANGENTS. $\frac{a+b}{a-b} = \frac{\tan \frac{1}{2}(A+B)}{\tan \frac{1}{2}(A-B)}$ TANGENT ANGLES. See Angles; TANGENT CIRCLES, See Circles. TANGENT LINES, See Lines. TANGNET PLANE TO A CONE, when a plane touches the conical surface along single line. TANGENT PLANE TO A CYLINDER, when it touches the cylinder along one line. TANGENT PLANE TO A SPHERE, when the plane touches the spherical surface at a single point. POINT TANGENCY, that single point at which a line or plane intersects the surface of another figure.

TAPE. A long narrow strip of steel used by surveyors in measuring distances.

TERM. A number expressed whose parts are not separated by the + or - sign. CONSTANT TERM, as in a quadratic equation, the term that does not contain the unknown number. DEGREE OF A TERM, the number of its literal factors; that indicated by the sum of the exponents of the literal factors.

TERMS. DISSIMILAR TERMS. Terms which are not alike. Two terms which do not have the same literal factor. HOMOGENEOUS TERMS, when all the TERMS of an expression are of the same degree. TERMS OF A PROPORTION See Proportion. PARTLY SIMILAR TERMS, are terms that have a common factor. NEGATIVE TERM, a term proceeded by a minus (-) sign.

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POSITIVE TERM, one preceeded by a plus (+) sign; the sign may be expressed or understood. SIMILAR TERMS. Also LIKE Terms. Terms that are alike in every respect except their coefficients. Terms that contain the same letters with the same exponents, UNLIKE TERMS. Terms which do not have the same literal factors.

TERMINAL LINE. Of an angle is the rotating line in its final position.

TEST. To examine or try by the application of certain processes. TEST OF EQUALITY. See Equality.

TETRAHEDRON. A triangular pyramid which has four triangular faces. REGULAR TETRAHEDRON. A polyhedron having as faces four identical equilateral triangles.

THALES OF MILETUS - (640 - 546 B. C.) He was one of the "seven wise men", and the founder of the Ionic School. As a merchant he accumulated much wealth and spent his later years in travel and study. While studying in Egypt he became interested in geometry. Upon his return to Greece he taught Geometry to his friends, who made many Contributions to the subjects. One of the theorems ascribed to him is the congruence of two triangles having a side and the two adjacent angles equal respectively.

THEODALITE. An instrument for measuring angles in a horizontal plane; also for measuring "angles of elevation" and "angles of depression".

THEOREM. A proposition, or a principle, to be proved. THE BINOMIAL THEOREM, A formula by which a binomial with any exponent may be expanded in a series. A THEOREM is the CONVERSE of another when the assumption and conclusion of one are respectively the conclusion and assumption of the other. REMAINDER THEORM, or factor theorm when substituting a number

K for X in a polynomial involving X, the resulting number is the remainder arising from dividing the polynomial X-K. STURM'S THEOREM. A rule to determine the number and situation of the real ROOTS OF any numerical equation.

THEORY OF EQUATIONS. That part of mathematics which studies the relations between the coefficients of an equation and its roots.

THEREFORE. denoted by the symbol ∴.

THERMOGRAPH. An instrument which traces graphs of changing temperatures.

THICKNESS. From top to bottom, also called HEIGHT, DEPTH or ALTITUDE.

THIRD PROPORTIONAL. See Proportional.

THIRD POWER. See Power.

THIRD DEGREE. See Degree.

TIME. An expression of the number of units or duration; as minutes, hours, days, etc.

TRAJECTORIES, ORTHOGONAL. Where two families of plane curves are so related that each curve of one system cuts every curve of the other system at right angles, each of these two systems is said to be the orthogonal tragectories of the other system.

TRANSIT. An instrument which measures angles; consists essentially of two graduated circles and a telescope which is so adjusted that it can revolve completely in either a horizontal or vertical plane.

TRANSFORM. V. To change the form of, as an algebraic expression without altering the value. The rearrangement into another form with without changing the value. To solve a literal equation for a specified letter

involves TRANSFORMING the equation by applying certain fundamental principles.

TRANSPOSE, To bring (any term of an equation) from one side over to the other, without destroying the equation.

TRANSPOSITION. Act or state of being TRANSPOSED.

TRANSVERSE AXIS. The longer axis of an ellipse.

TRANSVERSAL. A straight or curved line which intersects any system of other lines.

TRAPEZOID. A quadrilateral that has one pair of opposite sides parallel. THE ALTITUDE OF A TRAPEZOID, the perpendicular distance between parallel sides. THE MEDIAN of a trapezoid is the line-segment connecting the midpoints of its non-parallel sides. ISOCELES TRAPEZOID when the non-parallel sides are equal.

TRAPEZIUM, a quadrilateral having no two sides parallel.

TRIANGLE. A portion of a plane bounded by three straight lines; the bounding lines are the SIDES, and the points where the sides meet are the VERTICES. The ALTITUDE of a triangle is the length of a perpendicular from any vertex to the opposite side. The AREA of a triangle, one-half the product of its base and altitude. ACUTE triangle. See Acute. BASE of a triangle is any one of the three sides. BI-RECTANGULAR SPHERICAL TRIANGLE one of two right angles. CENTROID OF TRIANGLE. The point of intersection of the three medians of a triangle. EQUIANGULAR TRIANGLE. A triangle all of whose angles are equal. EQUILATERAL TRIANGLE, a triangle all of whose sides are equal. EXCENTER OF THE TRIANGLE, the point of intersection of the bisectors of

of two exterior angles of a triangle and the third interior angle. EXTERIOR ANGLE OF A TRIANGLE is equal to the sum of the two interior angles not adjacent and is greater than either of them. The supplement of any interior angle. GENERAL TRIANGLE. A triangle whose sides may be produced indefinitely. INCENTER OF A TRIANGLE. The point of intersection of the bisectors of the angle of a triangle. ISOCELES TRIANGLE. A triangle in which two of the sides are equal. LEGS OF RIGHT TRIANGLE See Right Triangle. MEDIAN OF A TRIANGLE. A line-segment from any vertex to the middle point of the opposite side. OBTUSE TRIANGLE. See Obtuse. OPPOSITE SPHERICAL TRIANGLE. See Spherical Triangle. ORTHOCENTER OF TRIANGLE. The point of intersection of the altitudes of a triangle. The PERIMETER of a Triangle is the sum of its sides. RIGHT TRIANGLE. See Right. SCALENE TRIANGLE A triangle in which no sides are equal. SPHERICAL TRIANGLE A spherical polygon of three sides. TRIRECTANGULAR TRIANGLE. A spherical triangle of three right angles. THE VERTEX OF A TRIANGLE The vertex opposite to the base. The angle opposite to the base is the ANGLE AT THE VERTEX. VERTICES OF A TRIANGLE. The three points of intersection of the sides of the triangle.

TRIANGLES. CONGRUENT TRIANGLES. Two triangles that have exactly the same size and shape. MUTUALLY EQUIANGULAR TRIANGLES. Two triangles whose corresponding angles are equal. MUTUALLY EQUILATERAL TRIANGLES. Two triangles whose corresponding sides are equal. POLAR TRIANGLES. Two spherical triangles, if from the vertices of one as poles arcs of great circles are drawn the other is formed. SIMILAR TRIANGLES. Two triangles which have their corresponding and angles equal and corresponding sides proportional.

TRIANGULAR PYRAMID. See Pyramid.

TRIGONOMETRIC. Of or pertaining to trigonometry.

TRIGONOMETRIC EQUATIONS. Expressions which are true only for certain values of the angle. TRIGONOMETRIC FUNCTION. See Function. (Trigonometric pyramid, trigonometric ratios); see nouns.

TRIGONOMETRY. The branch of mathematics that deals with the relations between the sides and angles of triangles (plane or spherical), and the calculations, etc., based on these. PLANE TRIGONOMETRY treats of plane triangles.

TRIHEDRAL. Having, or formed by three planes meeting in a point. TRIHEDRAL ANGLE. A polyhedral angle formed by three rays. A TRIHEDRAL ANGLE WITh two face angles equal is ISOCELES.

TRINOMIAL. Consisting of or pertaining to three terms connected by the sign + , the sign - or both of these; a polynomial of three terms. TRINOMIAL SQUARE. See Square. PERFECT SQUARE TRINOMIAL. The result obtained from squaring binomial.

TRI-RECTANGULAR TRIANGLE. See Triangle.

TRISECT. To divide into three parts, esp. into three equal parts.

TRUNCATED. Having the vertex, apex, or end cut off by a plane. (Truncated prism, truncated pyramid); see nouns.

UNDETERMINED COEFFICIENT. See Coefficient.

UNIFORM MOTION. See Motion.

UNIT. The concrete measure by means of which quantity is measured. IMAGINARY UNIT. $\sqrt{-1}$ is indicated by i. (Unit of measure, unit of surface, unit of volume); see nouns.

UNKNOWN. A letter whose value is to be (or, more generally, a literal number appearing in an equation or inequality (or system of either or both) whose value is not known or assumed to be known) found by means of an equation.

UNKNOWN NUMBER. See Number.

UNLIKE TERMS. See Terms.

UNLIKE SURDS. See Surds.

UPPER NAPPES. See Nappes.

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VALUE. The number or amount represented by a figure, quantity, etc. The number which is denoted by a letter is a VALUE of the letter. The ABSOLUTE VALUE or NUMERICAL VALUE of a number is the number of units in it, regardless of sign of a complex number. VALUE OF RATION . See Ratio.

VARIABLE. A changing number; a number which in a given problem of discussion, may have different values. DEPENDENT VARIABLE. A variable whose value depends upon one or more other variables. INDEPENDENT VARIABLE. A variable whose value does not depend upon any other variable.

VARIABLE QUANTITY. See Quantity.

VARIATION. The act or process of varying, or the resulting state. A VARIATION OF SIGN occurs when two successive terms of a series have unlike signs. DIRECT VARIATION. The type of variation that shows that although the variables in each of the equations charge, the ratio remains constant.

VARIES. One variable VARIES AS another if, as they vary, their ratio remains constant. One variable VARIES DIRECTLY as another if the quotient of any value of the one divided by the corresponding value of the other is constant. One number VARIES INVERSELY as another when the product of any value of the one and the corresponding value of the other is constant. One number VARIES DIRECTLY as the square of another if the quotient of any value of the one divided by the square of the corresponding value of the other is constant.

VECTOR. A straight line segment of definite length, direction and sense.

VELOCITY. Of a moving object, is the distance passed over in

the unit of time (e.g. and hour) usually velocity in a values direction as well.

VERIFYING. See checking; also the process of proving that a root satisfies an equation.

VERSED Turned.

VERSED SINE. See Sine.

VERTEX. The highest point; apex. The point of intersection of two adjacent sides of a polygon or adjacent faces of a solid.

VERTEX OF AN ANGLE. See Angle. VERTEX OF A CONICAL SURFACE. See Conical Surface. (Vertex of a cone, Vertex of a Pencil Of Lines, Vertex of a polyhedral angle, Vertex of a pyramid, Vertex of a Spherical Angle, Vertex of a triangle), See Nouns.

VERTICAL. Being in a position or direction perpendicular to the plane of the horizon; an upright position. (Vertical Dihedral Angle, Vertical Axis, Vertical Line), See Nouns.

VERTICES. CONSECUTIVE VERTICES. Two vertices which have one side between them (Vertices of a polyhedron, Vertices of a Spherical Polygon. Vertices of a Triangle), See Nouns.

VINCULUM. A symbol of aggregation. ——— a long bar.

VOLUME. It is the product of the length, width, and height, of any rectangular figure. The measure of the magnitude of a solid. The UNIT OF VOLUME is the volume of a cube of which each edge is the unit of length.

VOLUME OF A SOLID. See Solid.

WATT. An electrical unit of power.

WEDGE. A SPHERICAL WEDGE A portion of a sphere bounded by a lune and two great semicircles.

WEIGHT. The quality of being heavy. a definite mass. The measure of the force with which bodies tend toward the earth's center.

WORK PROBLEMS See Problems.

WHOLE NUMBER. See Number.

X - AXIS. The horizontal axis of reference.

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Y - AXIS. The vertical axis of reference, or in case of oblique coordinates, the axis of reference intersecting the X - Axis at some other angle than 90°.

ZONE. That portion of the surface of a sphere included between two parallel planes. The ALTITUDE OF THE ZONE is the distance between the parallel planes. The BASES of the zone are the circles in which the planes cut the sphere.

ZONE OF ONE BASE. A zone when one of the parallel planes is tangent to the sphere.

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